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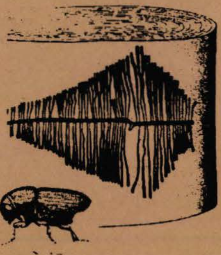
IDAHO FOREST INSECT AND DISEASE CONDITIONS SUMMARY

1996 – 1997 – 1998



IDAHO Department of Lands
USDA Forest Service
Northern & Intermountain Region

IDAHO FOREST
INSECT & DISEASE CONDITIONS
1996
1997
1998

Compiled by
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INTRODUCTION

This report summarizes major insect and disease activity on forested lands of all ownerships within the State of Idaho for 1996- 1998. Much of the information for this report was derived from aerial and ground surveys and associated detection and evaluation activities by insect and disease specialists within the USDA Forest Service and the Idaho Department of Lands. Acres and numbers of trees reported in tables are only estimates. Likewise, maps outlining areas of major insect infestations only provide general locations of mortality.

Forest insects, bark beetles and defoliating insects are featured in this report because these insects commonly occur as "outbreaks" and are readily observed from aerial surveys. Effects of most significant forest diseases are not readily assessed from the air. Therefore, only general information and observations on diseases are reported here.

Insects and diseases affect the health of forests in many ways. A broader, more comprehensive discussion of these effects and their significance is contained in "Health of Idaho's Forests, A Summary of Conditions, Issues and Implications." National Forest designations include all adjacent state and private ownerships as well as federal lands.

CONDITIONS IN BRIEF

FOREST INSECTS

Tree mortality attributed to mountain pine beetle increased throughout Idaho for the past three years with 41,000 in 1996, 63,000 in 1997 and 85,000 observed in 1998 in all pine species, on all ownerships. The largest outbreaks were located on the Nez Perce National Forest in 1998 with 43,500 dying lodgepole pine. Tree mortality attributed to pine engraver beetle and western pine beetle also increased throughout Idaho for the past three years with 8,000 in 1996, 16,100 in 1997 and 21,400 in 1998 in all tree species, on all ownerships. The largest outbreaks were located on the Coeur d'Alene National Forest in 1998 with 10,100 dying lodgepole and ponderosa pine. Tree mortality attributed to spruce beetle decreased throughout Idaho for the past three years with 1,600 in 1996, only 360 in 1997 and 470 in 1998 on all ownerships. The largest outbreaks were located on the Salmon-Challis National Forests in 1996 with 690 dying spruce trees. Tree mortality attributed to Douglas-fir beetle increased throughout Idaho over that of 1995 to 70,000 in 1996, with a large decrease to only 16,400 in 1997 and a large increase to 90,000 in 1998 on all ownerships. The largest outbreaks were located on the Nez Perce National Forest in 1998 with 35,300 dying Douglas-fir. In association with the large Douglas-fir beetle outbreak in 1998 there was a large influx of wood borers that killed large amounts of Douglas-fir trees outright of all sizes mostly in northern Idaho. Tree mortality attributed to the fir engraver decreased throughout Idaho from that of 1995 to only 24,100 in 1996, with a large increase to 71,500 in 1997 and a large decrease to only 11,300 in 1998 on all ownerships. The largest outbreaks were located on the Clearwater National Forest in 1997 with 34,500 dying grand fir. Tree mortality of subalpine fir was divided between north and south Idaho with the mortality attributed to western balsam bark beetle all in the north and tree mortality in southern Idaho attributed to a complex of subalpine fir mortality agents. Tree mortality attributed to western balsam bark beetle decreased throughout Idaho for the past three years with 11,500 in 1996, 5,400 in 1997 and another 5,400 in 1998 on all ownerships. The largest outbreaks were located on the Kaniksu National Forest in 1996 with 4,500 dying subalpine fir trees. Tree mortality attributed to the subalpine fir complex also decreased throughout Idaho for the past three years with 34,400 in 1996, 26,000 in 1997 and only 8,100 in 1998 on all ownerships. The largest outbreaks were located on the Sawtooth National Forest in 1996 with 16,800 dying subalpine fir trees. There has been no visible defoliation from Douglas-fir tussock moth in Idaho during 1996, 1997, or 1998. There has also been no visible defoliation from western spruce budworm during the same time period. Subalpine fir mortality has been increasing due to the high balsam woolly adelgid populations. It has increased from 24,300 acres in 1996 to 56,300 acres in 1997 and 53,400 acres in 1998, mostly on the St Joe, Clearwater and Nez Perce National Forests.

FOREST DISEASES

The most important diseases in northern Idaho are root diseases and white pine blister rust. Dwarf misletoes continue to be the most damaging disease-causing agents in southern Idaho. Diseases account for large amounts of tree mortality each year. Some disease-associated mortality is related to levels of insect activity, such as bark beetles, which often attack root-diseased trees. A devastating ice storm in November, 1996 caused extensive tree damage in northern Idaho. This damage was later related to increasing insect and disease activity in many stands. Outbreaks of conifer foliage diseases have occurred periodically throughout Idaho. Although tree damage from such outbreaks appears extensive, actual effects of foliar pathogens on trees are usually minor.

FOREST INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE

Mountain pine beetle is a native bark beetle that attacks lodgepole, ponderosa, western white, and other pines. The beetle ranges throughout western pine forests from Canada into Mexico. Beetles infest mature and overstocked stands of pines.

1996-In Idaho, mortality increased with 41,000 trees killed (Table 1, Figure 1) compared to 17,000 trees killed in 1995. Mortality occurred in all pine species, lodgepole, ponderosa, white pine, and whitebark pine. Beetle populations have taken advantage of favorable weather conditions over the past couple of years and an increasing amount of lodgepole pine, which is growing into more susceptible age classes in northern Idaho. Populations remain quite active, and may be expected to increase on parts of the Idaho Panhandle National Forests. The largest outbreak in Idaho was located on the St. Joe National Forest in lodgepole pine with 14,623 trees killed (Table 1). Numerous large groups of mountain pine beetle-killed lodgepole pine were mapped within the Bitterroot Mountain Range, just west of the ID/MT border, near Cascade Point Lookout, Red Ives Work Center. Groups of mountain pine beetle-attacked western white pine were also found scattered throughout northern Idaho. White pine blister rust (BR) is likewise extensively found throughout much of northern Idaho. While there may often be an association between mountain pine beetle and BR-caused mortality, it should not be inferred that it is an obligatory one. Mortality of whitebark and limber pine attributed to mountain pine beetle infestation continued to increase in 1996, to just under 6,000 trees killed (Table 1, Figure 1). The largest outbreak was located on the Targhee National Forest with 4,725 trees killed (Table 1). Small, isolated infestations are located on other Forests.

1997-Mountain pine beetle populations increased again. In 1996, more than 41,000 trees had been killed, in all host species and on lands of all ownerships. In 1997, that figure increased to 63,000 trees killed (Table 1, Figure 1) by mountain pine beetle, with 54,000 of the total killed in lodgepole pine (Table 1). Beetle populations experienced favorable weather conditions over the past few years and an increasing amount of lodgepole pine in more susceptible age classes in northern Idaho. Populations remain quite active, and may continue to increase on parts of the Idaho Panhandle National Forests. The largests outbreak in Idaho were on the St. Joe National Forest where 20,000 lodgepole pine trees were killed (Table 1) and 8,500 lodgepole killed on the Nez Perce National Forest (Table 1). For that reporting area, several groups of mountain pine beetle-killed groups of lodgepole pine groups ranged in size from 200-1000 trees with as many as 3 trees per acre having been killed. Other, smaller and more scattered mountain pine beetle-killed ponderosa pine and western white pine were also found in the general reporting area. Smaller outbreaks occurred on other Forests throughout Idaho. Mortality of whitebark and limber pine attributed to mountain pine beetle attack continued to occur with 4,300 trees killed in Idaho. The largest outbreaks were on the Payette National Forest with over 2,800 trees killed (Table 1) in 1997.

1998-Mountain pine beetle populations once again increased significantly. In 1998, almost 85,000 trees were killed on 82,000 acres (Table 1, Figure 1), in all host species and on lands of all ownership. More than ninety percent of those beetle-killed trees were lodgepole pine. The most expansive outbreaks in Idaho were located on the Nez Perce National Forest with 43,500 lodgepole pine killed and on the St. Joe with over 22,000 lodgepole pine killed. Smaller outbreaks continued to occur on other Forests throughout Idaho. Mortality of whitebark and limber pine attributed to mountain pine beetle attack decreased. There were 2,600 trees killed (Table 1, Figure 1) in Idaho in 1998 with over 1,100 of those trees killed on the Nez Perce National Forest.

Table 1. Idaho Statewide summary; annual mountain pine beetle (**MPB**) mortality

		MPB (white pine) Estimated Mortality			**MPB** (ponderosa pine) Estimated Mortality			**MPB** (lodgepole pine) Estimated Mortality			**MPB** (whitebark pine) Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1996	0	0	0.0	2	10	0.8	11	118	10.6	0	0	0.0
	1997	0	0	0.0	6	6	0.5	0	0	0.0	0	0	0.0
	1998	0	0	0.0	761	336	26.9	247	295	26.6	75	40	4.4
Boise	1996	0	0	0.0	20	28	1.1	327	871	53.2	80	112	12.3
	1997	0	0	0.0	0	0	0.0	322	528	31.7	80	108	11.9
	1998	0	0	0.0	10	14	0.6	120	179	10.7	50	70	7.7
Caribou	1996	0	0	0.0	0	0	0.0	1,152	2,490	149.4	35	35	3.9
	1997	0	0	0.0	0	0	0.0	2,903	4,130	247.8	248	240	26.4
	1998	0	0	0.0	0	0	0.0	1,499	1,267	76.0	129	136	15.0
Clearwater	1996	463	363	145.2	38	75	6.0	3,936	2,403	216.3	0	0	0.0
	1997	426	364	145.6	29	74	5.9	2,928	2,900	261.0	2	3	0.3
	1998	443	310	124.0	35	33	2.6	1,774	1,772	159.2	4	6	0.7
Coeur d'Alene	1996	1,452	1,498	599.2	97	228	18.2	290	470	42.3	0	0	0.0
	1997	895	902	360.8	509	687	55.0	999	1,827	164.4	2	2	0.2
	1998	338	246	98.4	55	33	2.6	537	585	52.7	0	0	0.0
Kaniksu	1996	826	955	382.0	148	297	23.8	4,246	3,531	317.8	493	431	47.3
	1997	338	310	124.0	374	263	21.0	2,451	4,685	421.7	565	607	66.8
	1998	1,122	506	202.4	336	200	16.0	2,706	3,126	281.3	686	519	57.1
Kootenai	1996	12	8	3.2	0	0	0.0	2	5	0.5	0	0	0.0
	1997	4	3	1.2	0	0	0.0	0	0	0.0	0	0	0.0
	1998	4	4	1.6	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce	1996	30	33	13.2	120	275	21.9	1,902	2,473	222.6	4	5	0.6
	1997	4	2	0.8	118	349	27.9	7,688	8,521	766.9	66	5	0.6
	1998	34	35	14.0	828	944	75.5	38,962	43,556	3,920.0	2,919	1,119	123.1
Payette	1996	0	0	0.0	0	0	0.0	45	78	4.7	255	357	39.3
	1997	0	0	0.0	0	0	0.0	6,773	7,621	457.3	2,154	2,862	314.8
	1998	0	0	0.0	15	21	0.8	0	0	0.0	322	480	52.8
Salmon-Challis	1996	0	0	0.0	595	834	33.4	195	205	12.3	105	179	19.7
	1997	0	0	0.0	621	905	36.2	195	281	16.9	30	42	4.6
	1998	0	0	0.0	70	98	3.9	204	355	21.3	0	0	0.0
Sawtooth	1996	0	0	0.0	0	0	0.0	1,951	2,390	143.4	25	35	3.9
	1997	0	0	0.0	0	0	0.0	2,234	2,302	138.1	50	70	7.7
	1998	0	0	0.0	10	14	0.6	2,635	3,071	184.3	35	49	5.4
St. Joe	1996	514	495	198.0	53	50	4.0	10,984	14,623	1,316.1	0	0	0.0
	1997	188	255	102.0	49	31	2.5	19,460	19,671	1,770.4	0	0	0.0
	1998	1,402	1,261	504.4	4	7	0.6	21,870	22,783	2,050.5	0	0	0.0
Targhee	1996	0	0	0.0	0	0	0.0	5	7	0.4	2,378	4,725	519.8
	1997	0	0	0.0	33	50	2.0	65	91	5.5	174	251	27.6
	1998	0	0	0.0	0	0	0.0	40	84	5.0	70	98	10.8
Indian Res.	1996	0	0	0.0	0	0	0.0	54	186	14.0	0	0	0.0
	1997	0	0	0.0	190	200	12.0	190	448	33.6	0	0	0.0
	1998	0	0	0.0	6	15	0.9	377	378	28.4	0	0	0.0
BLM	1996	0	0	0.0	0	0	0.0	31	32	2.4	0	0	0.0
	1997	0	0	0.0	0	0	0.0	384	386	30.0	111	105	11.6
	1998	0	0	0.0	0	0	0.0	64	64	5.3	21	15	1.7
Other Lands	1996	0	0	0.0	5	7	0.4	162	156	11.7	0	0	0.0
	1997	0	0	0.0	140	171	10.3	659	631	47.3	10	25	2.8
	1998	0	0	0.0	10	14	0.8	769	735	55.1	51	69	7.6
Idaho Totals	1996	3,297	3,352	1,340.8	1,078	1,804	109.6	25,293	30,038	2,517.7	3,375	5,879	646.8
	1997	1,855	1,836	734.4	2,069	2,736	173.3	47,251	54,022	4,392.6	3,492	4,320	475.3
	1998	3,343	2,362	944.8	2,140	1,729	131.8	71,804	78,250	6,876.4	4,362	2,601	286.3

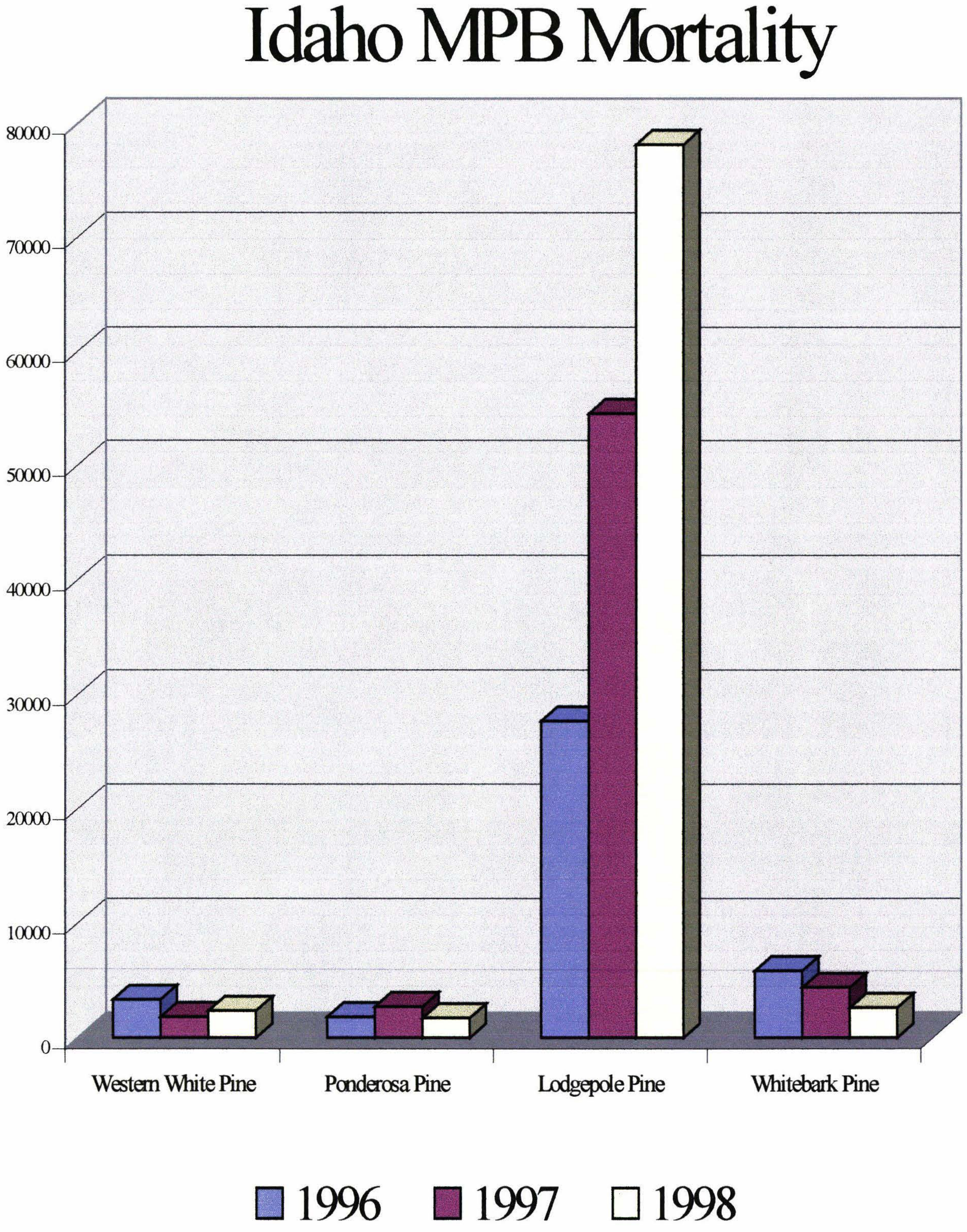


Figure 1. Mountain Pine Beetle Mortality by Host Species as determined by Aerial Surveys in Idaho 1996 - 1998

PINE ENGRAVER\WESTERN PINE BEETLE

In 1996 (Table 2, Figure 2) mortality due to pine engraver beetle decreased throughout Idaho, from 34,500 trees killed in 1995 to a total of only 1,200 trees killed in 1996. The largest outbreak occurred on the Nez Perce National Forest. Favorable weather during spring 1996, and again during the winter of 1996-97, throughout usually susceptible lower elevation ponderosa pine stands in northern Idaho, likely resulted in continuing low populations of pine engraver beetles in 1997. Likewise, land managers are becoming increasingly aware of the need for proper slash management during late-winter and early-spring logging in ponderosa pine stands. That, too, is helping reduce losses to engraver beetles. As was the case with other weather dependent bark beetle species, the number of ponderosa pine stands infested by the western pine beetle also decreased in Idaho. The decrease was from 24,000 trees killed in 1995 to fewer than 6,700 trees killed in 1996. Decreases occurred in virtually all reporting areas for which survey data were obtained. Most infestations were in widely scattered, small groups throughout the ponderosa pine type, with the majority of attacks occurring on the Boise, Clearwater, and Coeur d'Alene National Forest.

In 1997 (Table 2, Figure 2) pine engraver populations increased substantially over 1996 levels, they remained at nearly endemic levels throughout Idaho. Mortality due to pine engraver beetle increased throughout Idaho, to 4,000 trees killed in 1997. With the largest outbreak on the Coeur d'Alene National Forest, a likely result of winter damaged trees. As noted in low elevation ponderosa pine stands, some increases in western pine beetle caused mortality was noted in 1997. Those increases may have been the result of moisture induced stress and an abundance of winter damaged trees. Mortality due to western pine beetle increased to 12,100 dead trees on 15,900 acres, with the majority of attacked trees on the Clearwater and Payette National Forests, and on the Coeur d'Alene Indian Reservation lands.

In 1998 (Table 2, Figure 2) no significant pine engraver outbreaks were noted in Idaho, except for the Coeur d'Alene National Forest where just over 5,000 trees were killed. Statewide a total of 7,350 trees were killed by the pine engraver beetle in 1998. Overall, they remained at nearly endemic levels. Mortality due to western pine beetle increased to 14,100 trees on 18,000 acres, a slight increase over that of last year. The majority of attacked trees were reported on the Coeur d'Alene National Forest, and on lands of mixed ownership within the Coeur d'Alene Indian Reservation reporting area. The infested area was widespread. The intensity of tree mortality in most areas was less than one tree per acre.

SPRUCE BEETLE

In 1996 Spruce beetle activity was low again in Idaho. Only 1,600 faded trees were detected on 1,100 acres (Table 2, Figure 2), a slight increase from 1995. In 1996 activity was mainly confined to the Payette and Salmon-Challis National Forests. There were small groups found on most of the other National Forests.

During 1997 mortality from spruce beetle infestation decreased to only 360 trees. This decrease was attributed to a decline in host type on the Payette National Forest (Table 2, Figure 2), due to recent outbreaks and extensive wildfire in infested areas. No significant mortality was reported on any other National Forest in Idaho.

During 1998 mortality from spruce beetle infestation remained static, with only 475 killed trees reported and half of those were on the Payette National Forest (Table 2, Figure 2). Most occurred as small scattered groups of Engelmann spruce

Table 2. Idaho Statewide summary; annual bark beetle mortality by reporting area.

		Pine Engraver Beetle Estimated Mortality (PP&LPP)			**Western Pine Beetle** Estimated Mortality			**Spruce Beetle** Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1996	0	0	0.0	8	4	1.6	0	0	0.0
	1997	0	0	0.0	0	0	0.0	0	0	0.0
	1998	0	0	0.0	22	24	9.6	4	15	6.0
Boise	1996	324	237	2.4	1,367	1,246	685.3	125	161	77.3
	1997	25	36	0.4	1,816	1,099	604.5	0	0	0.0
	1998	180	252	2.5	0	0	0.0	20	28	13.4
Caribou	1996	0	0	0.0	0	0	0.0	5	7	3.4
	1997	0	0	0.0	0	0	0.0	10	14	6.7
	1998	0	0	0.0	0	0	0.0	50	63	30.2
Clearwater	1996	2	15	0.3	2,068	1,517	606.8	0	0	0.0
	1997	52	125	2.5	3,181	2,381	952.4	2	5	2.0
	1998	596	335	7.5	2,001	1,321	528.4	10	7	2.8
Coeur d'Alene	1996	36	65	1.3	1,160	1,448	579.2	0	0	0.0
	1997	396	2,527	51.6	460	779	311.6	9	20	8.0
	1998	2,221	5,067	122.0	5,520	5,029	2,011.6	13	5	2.0
Kaniksu	1996	42	110	2.3	519	542	216.8	11	15	6.0
	1997	32	73	2.5	189	266	106.4	14	21	8.4
	1998	88	410	9.8	372	551	220.4	2	2	0.8
Kootenai	1996	0	0	0.0	0	0	0.0	0	0	0.0
	1997	0	0	0.0	2	5	2.0	8	8	3.2
	1998	0	0	0.0	0	0	0.0	2	5	2.0
Nez Perce	1996	59	640	12.8	455	658	263.2	19	50	20.0
	1997	67	807	16.1	408	701	280.4	102	290	116.0
	1998	53	287	5.7	790	808	323.2	67	116	46.4
Payette	1996	10	14	0.1	1,145	719	395.5	415	605	290.4
	1997	0	0	0.0	4,398	2,710	1,490.5	200	285	136.8
	1998	0	0	0.0	0	0	0.0	240	213	102.2
Salmon- Challis	1996	0	0	0.0	0	0	0.0	469	690	331.2
	1997	0	0	0.0	0	0	0.0	5	7	3.4
	1998	0	0	0.0	0	0	0.0	5	7	3.4
Sawtooth	1996	0	0	0.0	0	0	0.0	15	21	10.1
	1997	0	0	0.0	35	21	11.6	0	0	0.0
	1998	0	0	0.0	0	0	0.0	20	28	13.4
St. Joe	1996	0	0	0.0	16	7	2.8	6	7	2.8
	1997	0	0	0.0	413	99	39.6	6	14	5.6
	1998	4	20	0.5	23	42	16.8	0	0	0.0
Targhee	1996	0	0	0.0	0	0	0.0	5	7	3.4
	1997	0	0	0.0	0	0	0.0	5	7	3.4
	1998	0	0	0.0	0	0	0.0	40	72	34.6
Indian Res.	1996	0	0	0.0	130	253	139.2	0	0	0.0
	1997	82	381	3.8	3,760	3,309	1,820.0	2	5	2.4
	1998	709	867	8.7	9,197	6,308	3,469.4	0	0	0.0
BLM	1996	0	0	0.0	30	18	9.9	5	7	3.4
	1997	0	0	0.0	155	93	51.2	0	0	0.0
	1998	0	0	0.0	0	0	0.0	0	0	0.0
Other Lands	1996	99	134	1.3	436	321	176.6	10	14	6.7
	1997	47	28	0.3	1,059	680	374.0	0	0	0.0
	1998	80	112	1.1	0	0	0.0	0	0	0.0
Idaho Totals	1996	572	1,215	20.4	7,334	6,733	3,076.9	1,085	1,584	754.7
	1997	701	3,977	77.2	15,876	12,143	6,044.2	363	363	295.9
	1998	3,931	7,350	157.8	17,925	14,083	6,579.4	473	473	257.2

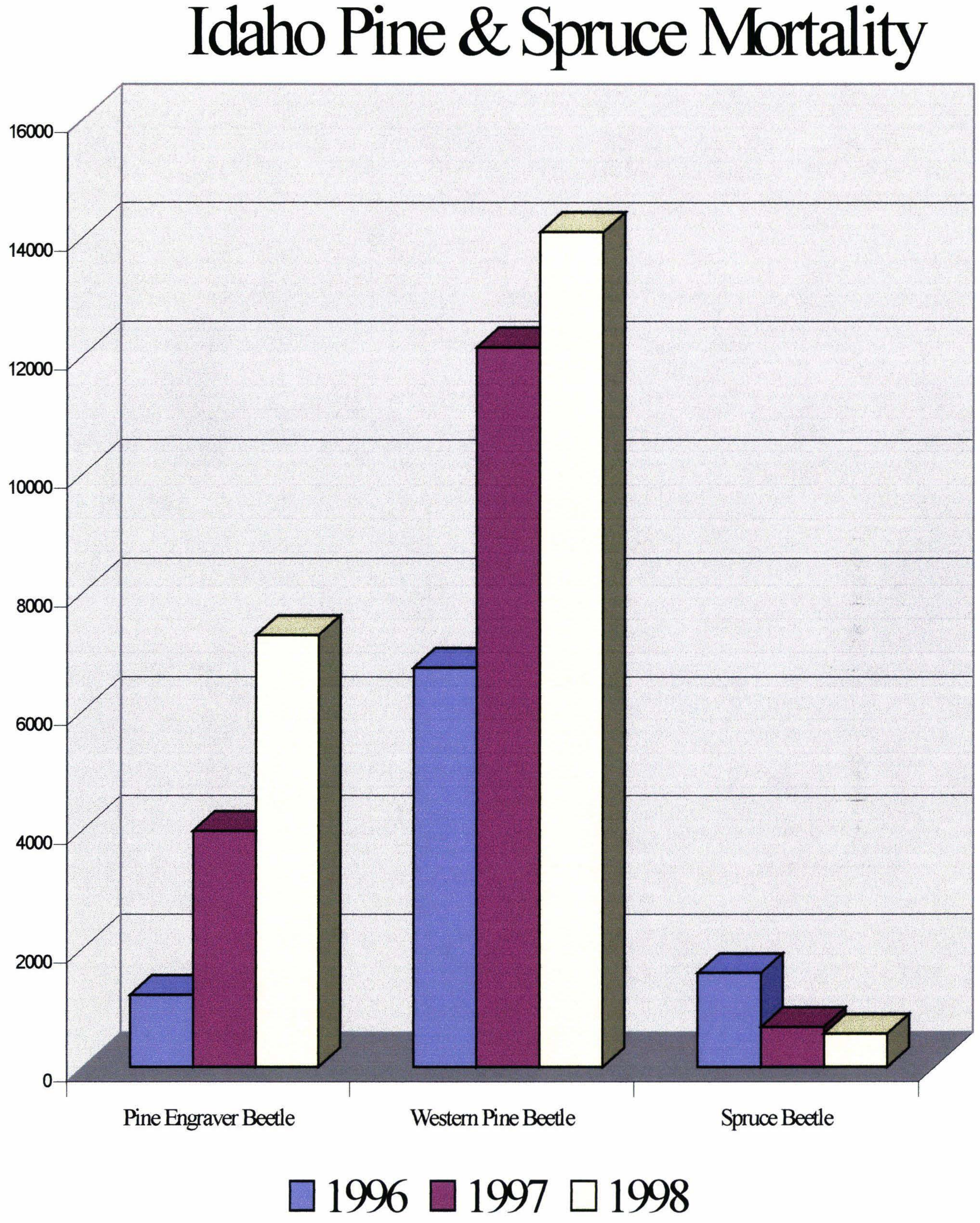


Figure 2. Pine and Spruce Mortality by Bark Beetle Species as determined by Aerial Surveys in Idaho 1996 - 1998

Table 3. Estimated spruce beetle caused mortality, 1985 - 1998

		ESTIMATED MORTALITY		
Forest and Adjacent Lands	YEAR	Acres Infested	Trees	MBF Volume
Boise	1985	55	84	40.2
	1986	--	1,095	523.4
	1987	607	669	319.8
	1988	155	254	121.4
	1989	175	227	108.5
	1990	100	40	19.1
	1991	0	0	0.0
	1992	571	141	67.4
	1993	500	500	239.0
	1994	0	0	0.0
	1995	0	0	0.0
	1996	125	161	77.3
	1997	0	0	0.0
	1998	20	28	13.4
Payette	1985	3,881	13,775	6,584.4
	1986	--	12,600	6,022.8
	1987	13,002	15,873	7,587.3
	1988	36,364	44,756	21,393.4
	1989	26,451	32,108	15,347.6
	1990	152,810	185,460	88,649.9
	1991	36,100	23,800	11,376.4
	1992	31,155	31,719	15,161.7
	1993	35,600	35,200	16,825.6
	1994	4,600	8,700	4,158.6
	1995	500	800	382.4
	1996	415	605	290.4
	1997	200	285	136.8
	1998	240	213	102.2
Totals	**1985-1998**	**343,626**	**400,093**	**196,364.6**

DOUGLAS-FIR BEETLE

In 1996 Statewide mortality, caused by Douglas-fir beetle infestation, increased from previous levels with 44,600 trees reported in 1995 to 70,000 trees killed (Table 4, Figure 4) in 1996 on approximately 77,300 acres. The largest outbreaks were located on the Sawtooth, and Salmon-Challis National Forests, with 90% of the mortality occurring in the southern half of the State.

In 1997 outbreaks decreased throughout Idaho to only 16,400 killed trees (Table 4, Figure 4) reported. The largest decreases were in southern Idaho. With the largest outbreaks now located on the Nez Perce National Forests, many small groups of Douglas-fir beetle-killed trees were mapped south of Selway River. Many small groups were also noted throughout the Clearwater and Slate Creek areas. In total, throughout the Nez Perce National Forest area 5,800 Douglas-fir trees on 1,700 acres were killed. Populations are generally low, likely in response to the significant amounts of moisture received during the winter of 1996-97. However, large amounts of winter damage (windthrow and snow breakage) may lead to population increases in areas where blowdown is not salvaged in a timely manner. The potential for expanding populations and additional tree mortality in 1998, without judicious salvage efforts, are high in parts of northern Idaho.

In 1998 as a result of large amounts of wind-thrown and storm damaged Douglas-fir, throughout many parts of northern Idaho, during winter 1996-97, Douglas-fir beetle populations increased dramatically over the past two years. In Idaho more than 66,000 acres were known to be infested. An estimated 90,300 Douglas-fir were killed (Table 4, Figure 4) in 1997 and mapped as faders in 1998. Ground surveys indicated that in most infested acres on the IPNF's 4-7 trees were attacked in 1998 for every one killed in 1997. The course of outbreaks are dependent upon availability of susceptible hosts in infested areas, weather conditions for the next several seasons, and ability to silviculturally treat infested and threatened stands. The largest outbreaks occurred on the Nez Perce and Clearwater National Forests.

FIR ENGRAVER

In 1996 the number of fir engraver beetle-killed trees decreased dramatically (Table 4, Figure 4) in the northern half of the state in response to a more nearly normal precipitation during the winter of 1995-96 and the summer of 1996. In 1995, more than 242,000 acres showing some level of beetle activity were mapped in the northern half of the state. That decreased to less than 19,000 acres in 1996. The largest concentrations of engraver beetle-killed trees were observed on the Coeur d'Alene and Nez Perce National Forests, although other reporting areas in the northern half of the state showed significant mortality, as well. Only 200 trees were killed in the southern half of the state in 1996 compared to 400 trees in 1995. In 1996 a reported 24,100 grand fir trees were killed by the fir engraver in Idaho. Many, small and somewhat uniformly scattered groups were noted throughout the reporting areas.

In 1997 mortality and top-kill attributable to fir engraver increased markedly in the northern part of the state. That increase may have been in response to unusually high amounts of moisture received during late winter and early spring and resulting stress in some low-elevation grand fir stands. Fall surveys in 1997 indicated that most fir engraver killed mortality (Table 4, Figure 4) occurred on soils with a perched water table. In those areas, uncharacteristic flooding has been experienced during fall 1995, spring 1996, and again in 1997. It is believed that the flooding caused grand fir trees to become physiologically stressed, making them more susceptible to beetle attacks. Supporting that premise is the lack of root disease in most areas where fir engraver caused mortality is high. During 1997, approximately 109,000 acres were infested and slightly more than 71,500 trees were killed in Idaho. Though representing a significant increase over the 19,000 acres infested in 1996, it is still considerably less than the 242,000 acres reported in 1995. Most of these infested trees were located on the Clearwater and St. Joe National Forests, and surrounding State and private land. On the western half of the Clearwater National Forest, and on adjoining State and private lands, many large groups of fir engraver killed grand fir were found. Highest concentrations were on State lands south of Mason Butte, on private lands south of Bovill, on federal and private lands east of Potlatch, and on State and private lands northeast of Moscow. Most infested stands averaged less than one tree per acre killed throughout the reporting area. Elsewhere, smaller and more scattered groups were noted.

In 1998 Fir engraver populations, and associated mortality in grand fir stands, declined markedly from 1997 levels, to an estimated 11,300 trees (Table 4, Figure 4) almost all in northern Idaho were affected. A return to more typical moisture conditions in 1998 resulted in more endemic-like beetle populations. Some significant amounts of beetle-killed grand fir were noted widely scattered throughout host type; but for the most part, beetle-killed groups were small.

WESTERN BALSAM BARK BEETLE/ SUBALPINE FIR COMPLEX

In 1996 scattered groups of subalpine fir killed (Table 4, Figure 4) by western balsam bark beetle were observed on the Kaniksu National Forest with numerous groups (20-75 trees each) recorded from about the Kootenai River, north to the Canada/US border. An estimated 11,500 trees were reported killed in Idaho with almost 9,000 of those trees observed on the Kaniksu and Nez Perce National Forests in 1996.

In 1997 Western balsam bark beetle decreased to just over 5,400 trees (Table 4, Figure 4) on 4,200 acres with tree mortality in high-elevation subalpine fir stands with most of the mortality recorded on the Kaniksu and Nez Perce National Forests.

In 1998 Western balsam bark beetle populations stayed about the same as last year with tree mortality in high-elevation subalpine fir stands. Of the infested area recorded, approximately 5,300 acres with 5,400 trees killed (Table 4, Figure 4) were in northern Idaho, principally on the Nez Perce National Forest.

In 1996 a complex of western balsam bark beetle, twig beetle, secondary bark beetles, wood borers, engraver beetle, environmental conditions, and pathogens continues to damage and kill subalpine fir throughout southern Idaho. Mortality levels decreased to 34,400 trees killed (Table 4, Figure 4). Mortality throughout the host type affects trees of all size classes.

Again in 1997 the complex of tree killing agents continued to damage and kill subalpine fir throughout southern Idaho. Mortality levels decreased to 25,900 trees killed (Table 4, Figure 4). Mortality throughout the host type affects trees of all size classes.

In 1998 A significant decline in subalpine fir mortality attributed to the complex of insect and disease factors was observed throughout host type. In 1998 mortality dropped dramatically to 8,000 trees killed (Table 4, Figure 4). Mortality throughout the host type continues to affects trees of all size classes.

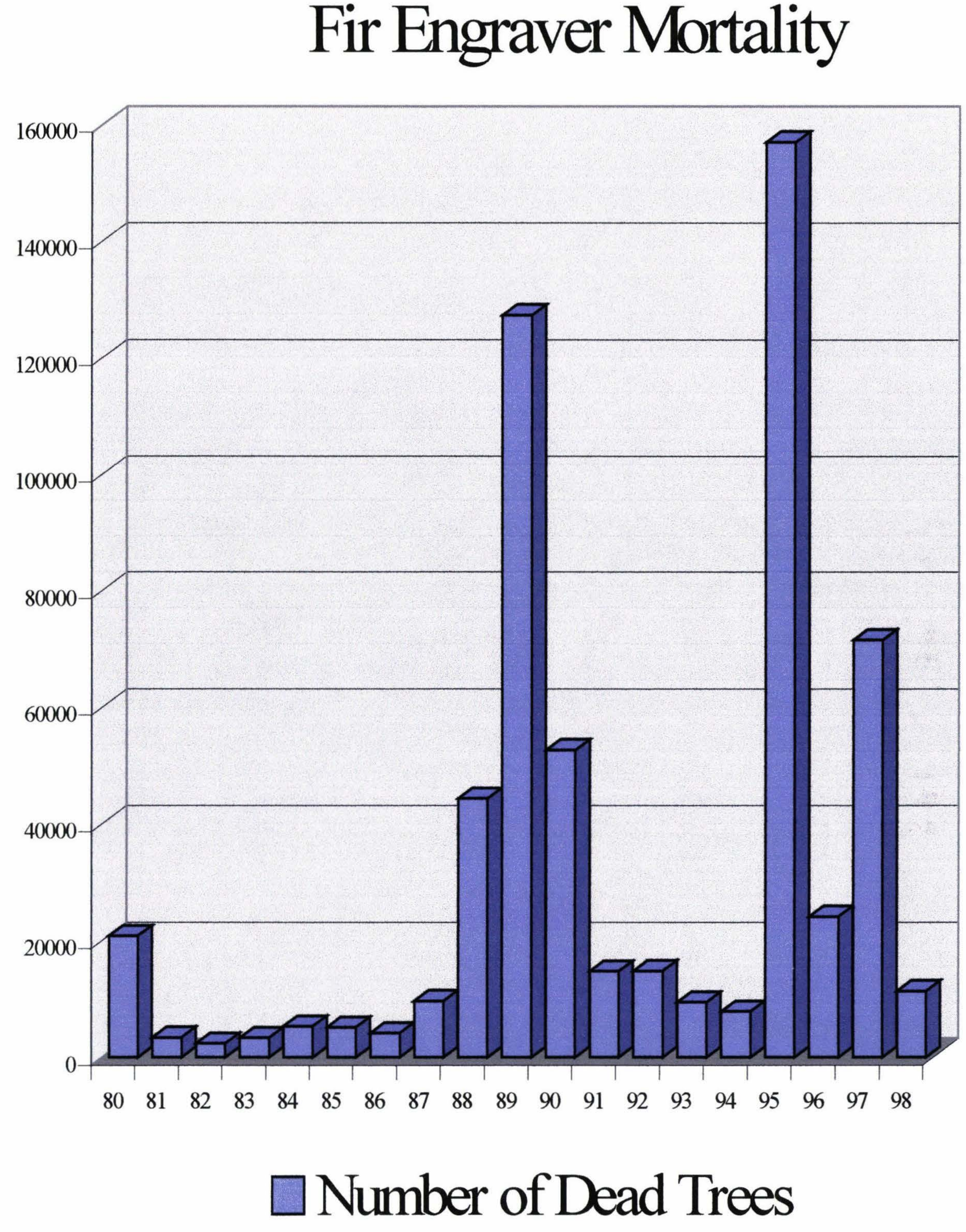
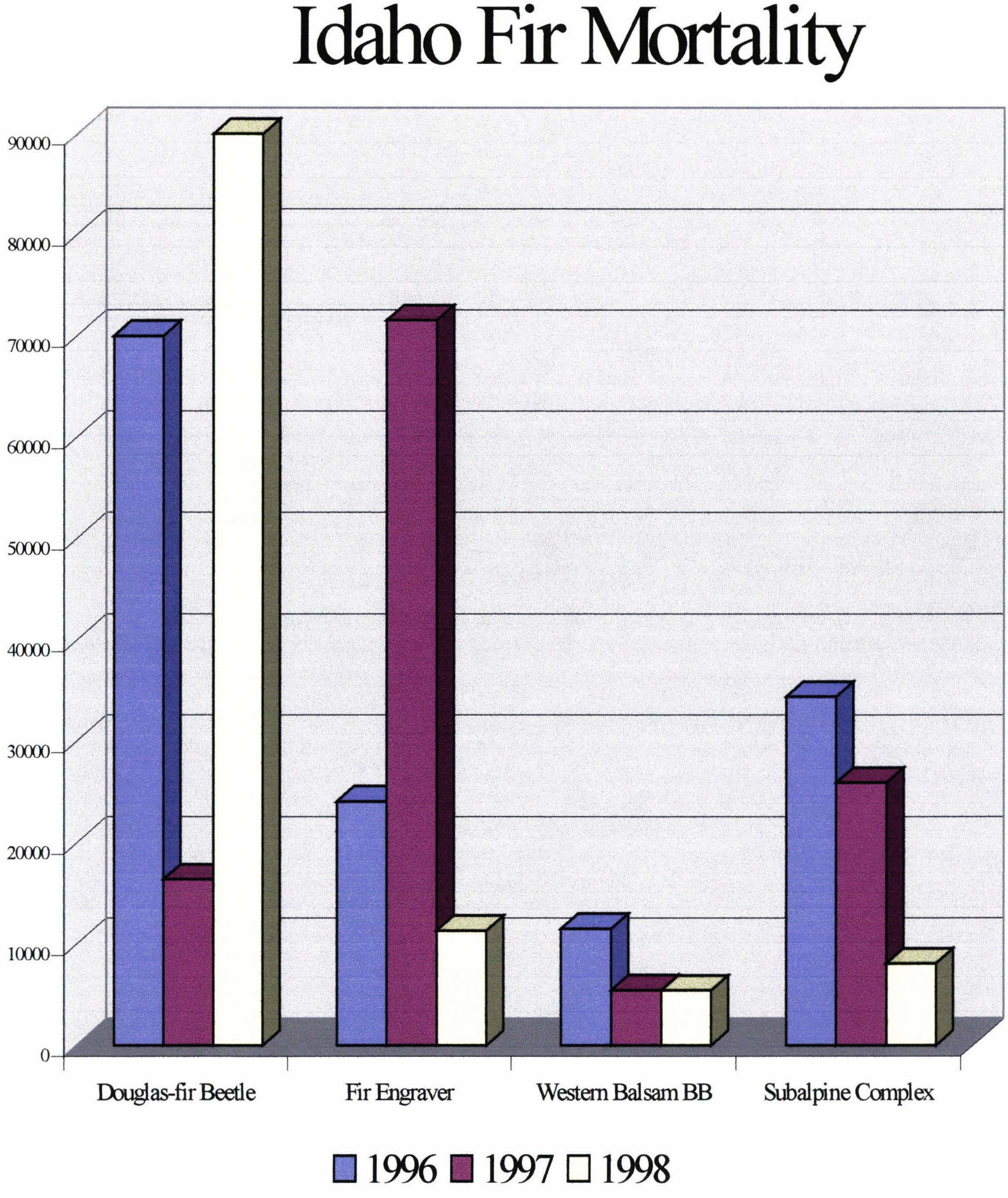


Figure 3. Mortality Caused by the Fir Engraver
as determined by Aerial Surveys in
1980- 1998

Table 4. Idaho Statewide summary; annual bark beetle mortality by reporting area.

		Douglas-fir Beetle Estimated Mortality			**Fir Engraver** Estimated Mortality			**Western Balsam Bark Beetle** Estimated Mortality			**Subalpine fir Complex** Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	1996	36	94	32.9	0	0	0.0	16	60	6.6			
	1997	31	80	28.0	0	0	0.0	0	0	0.0			
	1998	4,297	6,072	2,125.2	0	0	0.0	68	78	8.6			
Boise	1996	17,499	11,567	1,642.5	70	33	6.3				1,908	2,699	296.9
	1997	405	572	81.2	15	21	4.0				310	369	40.6
	1998	1,600	2,552	362.4	5	7	1.3				0	0	0.0
Caribou	1996	1,090	1,378	195.7	0	0	0.0				6,512	7,738	851.2
	1997	400	494	70.2	0	0	0.0				12,023	10,534	1,158.7
	1998	1,211	1,741	247.2	0	0	0.0				2,407	1,413	155.4
Clearwater	1996	753	2,952	1,033.2	1,147	2,401	480.2	84	237	26.0			
	1997	1,367	2,186	765.1	73,553	34,515	6,903.0	225	421	46.3			
	1998	26,734	25,121	8,792.4	4,329	2,348	469.6	287	456	50.2			
Coeur d'Alene	1996	33	77	27.0	8,553	11,124	2,224.8	189	525	57.8			
	1997	42	96	33.6	1,439	2,512	502.4	104	190	20.9			
	1998	2,730	1,651	577.9	694	1,355	271.0	102	84	9.2			
Kaniksu	1996	201	441	154.4	2,848	4,195	839.0	3,013	4,484	519.0			
	1997	122	302	105.7	985	750	150.0	1,507	1,947	214.2			
	1998	463	998	349.3	156	267	53.4	412	510	56.1			
Kootenai	1996	0	0	0.0	0	0	0.0	0	0	0.0			
	1997	0	0	0.0	2	2	0.4	0	0	0.0			
	1998	8	14	4.9	0	0	0.0	0	0	0.0			
Nez Perce	1996	1,803	6,783	2,374.1	4,688	4,718	943.6	3,808	4,345	478.0			
	1997	1,775	5,862	2,051.7	3,525	5,771	1,154.2	1,719	2,232	245.5			
	1998	15,480	35,348	12,371.8	2,021	2,421	484.2	4,181	3,781	415.9			
Payette	1996	12,345	7,065	1,003.2	15	21	4.0				235	335	36.9
	1997	2,051	2,185	310.3	168	250	47.5				245	272	29.9
	1998	6,552	5,637	800.5	0	0	0.0				0	0	0.0
Salmon-Challis	1996	9,482	12,596	1,788.6	0	0	0.0				1,006	1,468	161.5
	1997	390	559	79.4	5	7	1.3				1,373	1,855	204.1
	1998	743	1,274	180.9	0	0	0.0				0	0	0.0
Sawtooth	1996	28,608	22,717	3,225.8	0	0	0.0				13,116	16,807	1,848.8
	1997	995	1,406	199.7	0	0	0.0				3,042	3,680	404.8
	1998	795	1,204	171.0	333	327	62.1				2,954	3,240	356.4
St. Joe	1996	115	320	112.0	1,267	1,555	311.0	1,440	1,879	206.7			
	1997	416	409	143.2	31,671	22,548	4,509.6	682	658	72.4			
	1998	1,978	3,600	1,260.0	3,409	2,422	484.4	300	516	56.8			
Targhee	1996	295	413	57.8	0	0	0.0				355	497	54.7
	1997	145	225	31.5	0	0	0.0				300	432	47.5
	1998	1,106	1,672	234.1	0	0	0.0				206	219	24.1
Indian Res.	1996	105	110	26.0	14	40	8.0				3,550	2,488	273.7
	1997	485	1,007	322.3	4,639	5,185	1037.0				8,827	3,443	378.7
	1998	1,257	2,215	758.7	2,731	2,185	437.0				409	445	49.0
BLM	1996	4,015	2,654	371.6	10	14	2.7				427	706	77.7
	1997	482	584	81.8	0	0	0.0				1,355	1,748	192.3
	1998	301	306	42.8	0	0	0.0				166	171	18.8
Other Lands	1996	971	842	117.9	30	42	8.0				1,591	1,706	187.7
	1997	341	432	60.5	0	0	0.0				7,842	3,618	398.0
	1998	718	945	132.3	5	7	1.3				4,567	2,596	285.6
Idaho Totals	1996	77,351	70,009	12,162.7	18,642	24,143	4,827.2	8,550	11,530	1,268.3	28,700	34,444	3,789.1
	1997	9,447	16,399	4,364.2	109,002	71,561	14,257.6	4,237	5,448	599.3	35,317	25,951	2,854.6
	1998	65,973	90,350	28,386.6	13,683	11,339	2,242.5	5,350	5,425	596.8	10,709	8,084	889.3



Idaho Fir Mortality

Figure 4. Fir Mortality
by Bark Beetle Species as determined
by Aerial Surveys in Idaho 1996 - 1998

DEFOLIATORS

DOUGLAS-FIR TUSSOCK MOTH

In 1996 Douglas-fir tussock moth populations remained at low levels (Table 5, Figure6). No aerially visible defoliation was detected, nor were any larvae found at those sites that were sampled. Moth catches in pheromone traps were at increased levels in Idaho. At 67 sites in Northern Idaho, 128 moths were caught in 1996 compared to 27 moths in 1995.

In 1997 Douglas-fir tussock moth populations increased, but were still at relatively low levels (Table 5, Figure6). No aerially visible defoliation was detected, nor were any larvae found at those sites that were sampled. Moth catches in pheromone traps were at increased levels in Idaho. At 70 sites in Northern Idaho, 1001 moths were caught in 1997 compared to 128 in 1996.

In 1998 Douglas-fir tussock moth populations, confirmed by trap catches, increased (Table 5, Figure6). No aerially visible defoliation was detected, however larvae were found at several sites sampled in northern Idaho. Moth catches in pheromone traps were at much higher levels throughout Idaho. At approximately 95 trapping sites in northern Idaho, about 6,500 moths were caught in 1998 compared to 1,001 in 1997. Some minor defoliation was observed on ornamental trees in residential areas, but none was noted in forest stands. Trap catches and observations suggest populations should continue to increase.

LARCH CASEBEARER

In 1996 western larch growing in McCall and Cascade, Idaho were defoliated by the larvae of this exotic moth that was introduced to Idaho in 1957. Defoliation was concentrated in residential areas and did not extend into generally forested areas.

In 1997, very noticeable defoliation caused by larch casebearer occurred in isolated patches in many western larch stands throughout northern Idaho from Sandpoint down to Grangeville for the first time in about 25 years. However, defoliation did not occur over areas large enough to be detected during aerial surveys. Introduced parasites are thought to be at least partly responsible for the collapse of larch casebearer populations during the 1970's, the last time populations were extremely high. Parasitism rates at that time were from 40-65 percent. Ground surveys conducted during 1997 showed low parasitism rates (1-13%, ave. 9%) on eight sites sampled. Overwintering population sampling was highly variable and predicted light to heavy defoliation at those sites for 1998. Western larch on the Payette National Forest were defoliated by the larvae of this exotic moth. Defoliation also occurred in residential areas of McCall and Cascade, Idaho in 1997.

In 1998, parasitism rates increased to 3-23% (ave. 12%) on the same sites sampled in 1997. Thirty-three additional sites were sampled with parasitism rates of 0-34% with an average of 7%. In some areas heavily hit in 1997 and 1998, populations appear to be declining. However, rates of parasitism are still relatively low compared to rates that were found in the 1970's during a population decline. Defoliation is expected to be quite variable in 1999 with many areas of heavy defoliation. Monitoring of population levels and parasitism rates will continue.

WESTERN SPRUCE BUDWORM

In 1995 no budworm defoliation was observed in Idaho for the first time since aerial surveys began in 1948. In 1996, again our aerial detection flights did not record any budworm defoliation (Figure 5) in Idaho. This represents a major shift from recent years when it was common to have over a million acres defoliated every year. Pheromone trap counts were up by only a few moths over 1995. Populations are starting to rebuild following favorable climatic conditions the spring and summer of 1995, but remain low. Defoliation is only expected in a few scattered areas where trap counts were above four or five moths per trap. Population recovery to pre-1994 levels may take several more years.

Once again in 1997, aerial detection flights recorded no budworm defoliation (Figure 5) in Idaho. There was, however, light defoliation noted on some permanent plots in northern Idaho. Pheromone trap counts were up significantly from 35 moths in 1996 to 415 moths in 1997. Populations appear to be rebuilding slowly, but remain low.

Again in 1998 no budworm defoliation was observed (Figure 5) in Idaho, the fourth consecutive year, however, trap catches were up in 1998.

BLACK-HEADED BUDWORM

Approximately 2,414 acres of mountain hemlock were defoliated in the Mallard Larkins Wilderness of the Idaho Panhandle NFs and adjacent Avalanche Creek in the Clearwater NF in 1996.

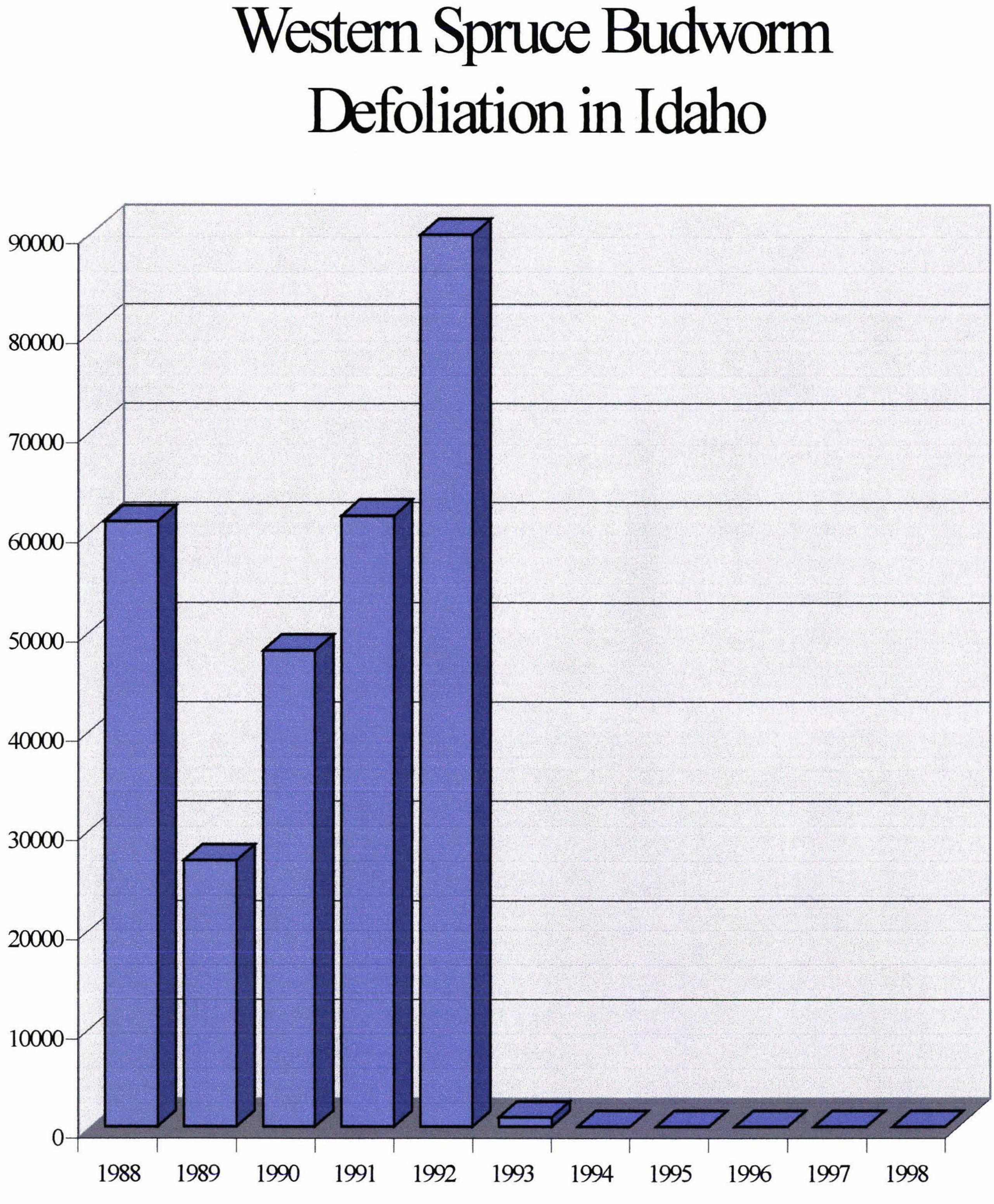


Figure 5. Acres of Western Spruce Budworm defoliation as determined by Aerial Surveys in Idaho 1988 - 1998

Douglas-Fir Tussock Moth

Table 5. Means of average moth catch per 5 pheromone trap/sample plots in Idaho, **1998-1988**

AREA	Number of 1998 sample plots	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988
STATE AND PRIVATE												
Coeur d'Alene	5	0.3	0.08	0.0	0.0	0.0	0.0	0.1	0.0	*	*	*
Coeur d'Alene	5	0.08	0.0	0.0	0.0	0.0	0.0	0.1	0.1	7.2	0.0	0.0
Plummer-Moscow	14	21.4	3.9	0.3	0.3	0.0	0.0	0.7	0.1	0.1	0.0	0.1
Plummer-Moscow	17	14.0	1.3	0.08	0.04	0.1	0.0	0.5	0.1	0.1	0.0	0.0
Plummer-Moscow	8	2.6	0.1	0.0	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.0
Plummer-Moscow	2	46.3	3.4	0.1	0.2	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Plummer-Moscow	4	50.8	2.4	0.2	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Plummer-Moscow	3	29.7	2.2	0.3	0.07	0.0	0.0	1.6	0.1	0.1	0.0	0.2
Plummer-Moscow	12	30.1	7.9	1.4	0.01	0.0	0.0	0.1	0.1	0.2	0.0	0.1
Craig Mountain	8	0.5	0.0	0.0	0.0	0.0	0.05	0.5	0.0	0.2	0.0	0.0
NEZ PERCE NF												
Selway RD	5	1.7	0.0	0.0	0.0	0.0	0.04	0.1	0.0	0.4	0.1	0.2
Salmon River RD	5	0.1	0.0	0.0	0.0	0.0	0.08	0.7	2.5	0.1	0.0	0.0
CLEARWATER NF												
Lochsa RD	1	0.4	0.0	0.0	0.0	0.0	0.0	0.2	1.2	0.0	0.2	0.0
Canyon RD	5	2.6	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.2	0.0	0.0
Pierce RD	5	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.3	0.0	0.1
BOISE NF												
Mountain Home	8	0.1	0.5	2.1	0.0	0.1	0.0	32.2	68.9	5.3	0.2	0.6
RD	*	*	*	*	*	*	0.0	23.5	59.6	65.6	*	*
Boise RD	9	0.0	0.0	0.0	0.0	0.0	0.0	0.6	27.2	*	*	*
Idaho City RD	5	0.04	0.0	0.0	0.0	0.0	0.0	0.4	0.7	31.6	0.0	0.2
Cascade RD	9	0.1	0.0	0.0	0.0	0.0	0.0	1.8	20.0	*	*	*
Lowman RD	8	3.0	0.3	0.02	0.0	0.0	0.02	1.2	19.7	*	*	*
Emmett RD												
PAYETTE NF												
Council RD	12	5.8	1.4	0.05	0.1	0.0	0.0	2.8	6.6	23.2	0.7	1.9
Weiser RD	12	26.9	3.6	0.6	0.1	0.1	0.0	2.4	21.4	67.0	0.8	0.7
New Meadows RD	11	5.3	0.6	0.02	0.0	0.0	0.0	1.6	8.8	*	*	*
McCall RD	6	0.6	0.0	0.0	0.0	0.0	0.0	0.8	0.7	*	*	*
SALMON NF												
Northfork RD	*	*	*	*	*	*	*	*	*	0.4	0.6	21.3
SAWTOOTH NF												
Fairfield RD	5	0.5	0.08	0.1	0.0	0.3	0.0	35.3	70.5	35.3	70.5	3.3
OTHER												
Owyhee Mountains	3	32.1	30.6	24.0	13.1	2.0	0.0	51.1	76.1	51.1	76.1	15.8
Sharps Canyon	1	*	0.4	0.0	0.0	0.0	0.0	18.8	*	18.8	*	36.4
Pine Rdg-Lost Lake	1	*	*	*	0.0	0.0	0.0	5.0	25.0	5.0	25.0	*

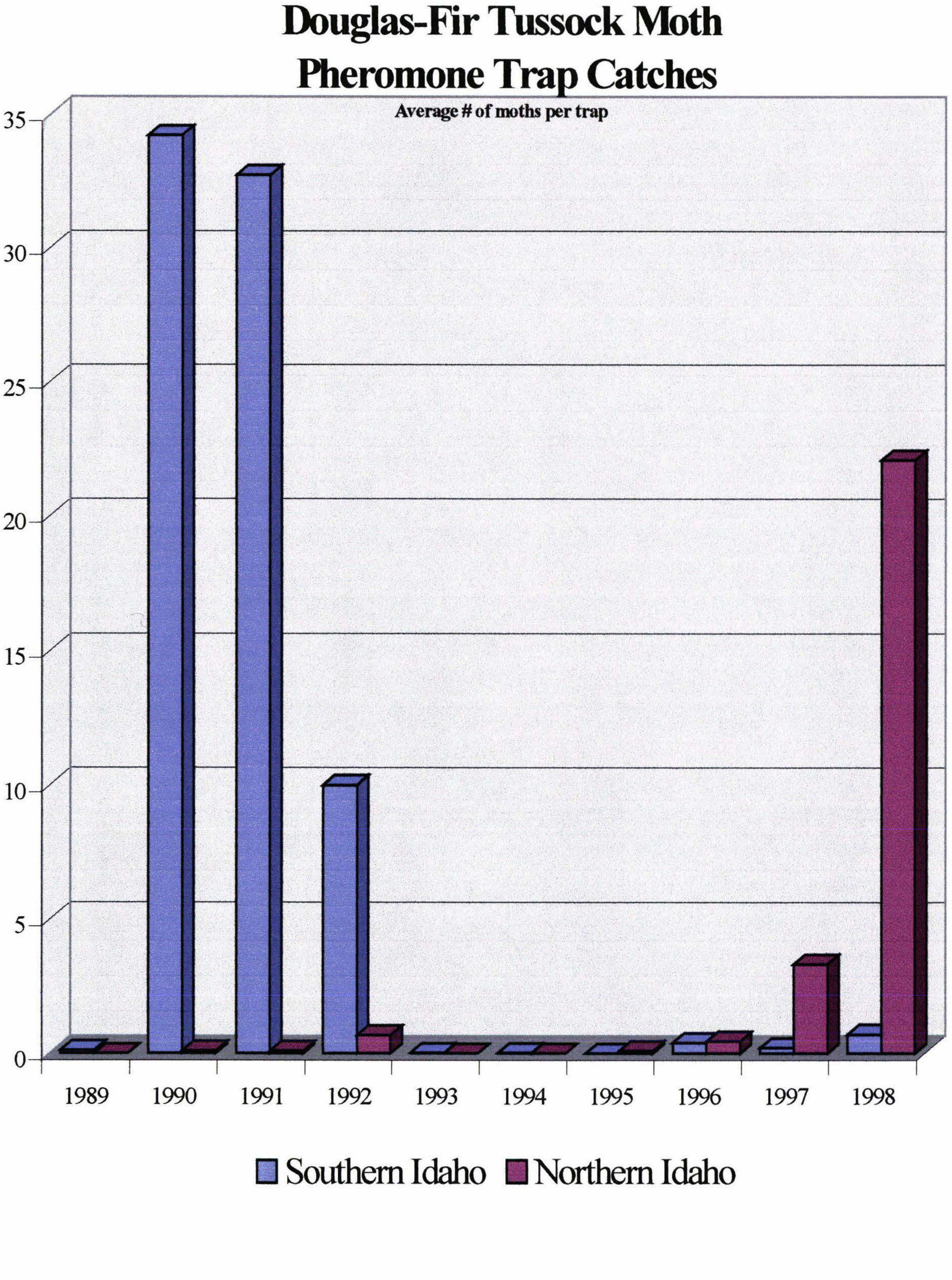


Figure 6. USFS and IDL
Douglas-fir Tussock Moth Trap Catches
in Idaho 1989 - 1998

GYPSY MOTH

The Idaho gypsy moth detection survey program systematically samples all populated areas of the State in order to detect introductions of gypsy moths. Many USDA Forest Service campgrounds are also sampled, as well as rest stops, tourist attraction sites and other locations where people congregate. High risk areas, those cities with the highest populations and the highest potential for newly arriving families, are trapped each year. Other areas are trapped every other year or every third year. The survey will continue to expand as cities grow and more people move into the rural areas of our state. All trapping results are incorporated into the National Agricultural Pest Information System (NAPIS) database.

DETECTION TRAPPING

The Idaho Department of Lands, the Idaho Department of Agriculture and the USDA Forest Service Regions 1 and 4, in cooperation with APHIS, placed 4407 pheromone baited traps throughout the state in 1996. 5105 traps were placed in 1997 and 4904 in 1998. Our target density for these detection traps is four traps per square mile. Added emphasis is given to cities, towns and rural areas where a sufficient number of new families moved in to generate an increased risk of introduction of gypsy moths. Tracking of these new "move-ins" is provided in a report compiled by the Idaho Department of Transportation showing the locations of people moving to Idaho from gypsy moth infested states. The report, derived from applications for vehicle title transfers, indicates that approximately 250 to 300 individuals or families move to Idaho each month from the generally infested states.

In 1996 and 1997 no gypsy moths were caught in Idaho. Seven gypsy moths were caught in 1998 (Figure 7). A single gypsy moth was found in a trap located in the city park at Arco (Butte County). Another single moth was caught at Weitas Campground on the Clearwater National Forest (Clearwater County). Of more concern were 5 gypsy moths caught in a single trap near Huetter between Coeur d' Alene and Post Falls (Kootenai County). Follow up surveys at the Huetter site found a current year egg mass and several older egg masses, along with evidence of other life stages. Eradication efforts and follow up trapping surveys are planned for this site in 1999.

Timing of trap placement is determined by use of the gypsy moth phenology model, GYMPHEN. Maximum and minimum daily temperatures for representative areas around the state are updated monthly for the model runs.

DELIMITATION TRAPPING

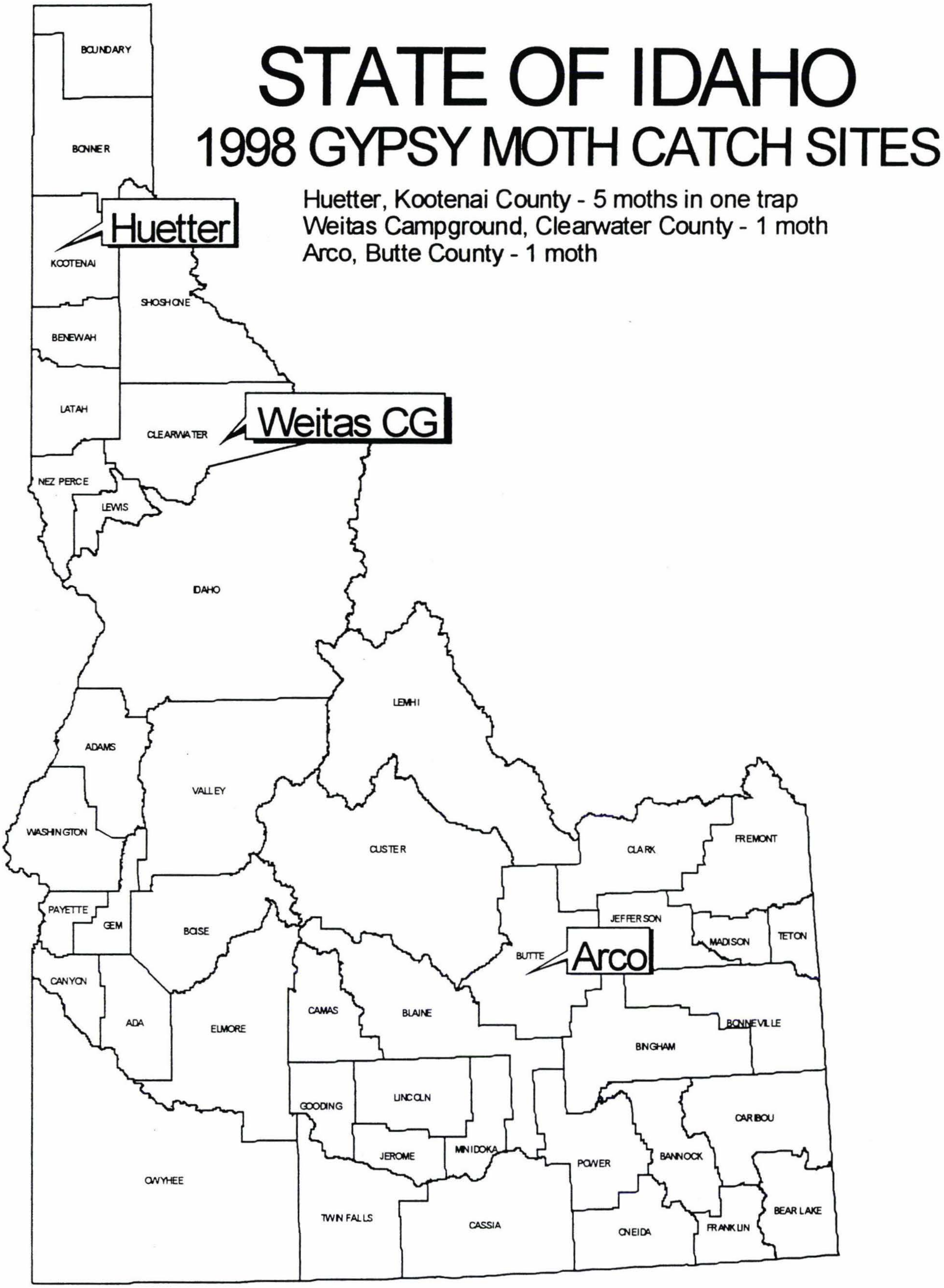
Delimitation trapping was done at 3 sites in 1996 where gypsy moths were caught in previous years. Those sites were Coeur d' Alene, Post Falls and Pocatello. One additional year of delimit trapping was done at Post Falls in 1997. No delimit traps were placed in 1998. No gypsy moths were caught in the delimit traps any of these years.

PREVIOUS INFESTATIONS

Eradication of previous infestations of gypsy moths in Sandpoint and in Coeur d'Alene, has now been confirmed for eight years. No moths were caught in or close to the treated areas after ground and aerial treatments in 1989 and 1990 with *Bacillus thuringiensis k.*

STATE ADVISORY COMMITTEE

An advisory committee, composed of representatives from the Idaho Department of Lands, The Idaho Department of Agriculture, The U. S. Forest Service Regions 1 and 4, and APHIS, reviews activities and provides guidelines for the gypsy moth program in Idaho.



STATE OF IDAHO

1998 GYPSY MOTH CATCH SITES

Huetter, Kootenai County - 5 moths in one trap
Weitas Campground, Clearwater County - 1 moth
Arco, Butte County - 1 moth

Huetter
Weitas CG
Arco
BOUNDARY
BONNER
KOOTENAI
SHOSHONE
BENEWAH
LATAH
CLEARWATER
NEZ PERCE
LEWIS
IDAHO
LEMHI
ADAMS
VALLEY
WASHINGTON
CUSTER
CLARK
FREMONT
PAYETTE
GEM
BOISE
JEFFERSON
MADISON
TETON
BUTTE
CANYON
ADA
ELMORE
CAMAS
BLAINE
BONNEVILLE
BINGHAM
GOODING
LINCOLN
CARIBOU
JEROME
MINIDOKA
POWER
BANNOCK
OWYHEE
TWIN FALLS
CASSIA
ONEIDA
FRANKLIN
BEAR LAKE

Figure 7. State of Idaho
1998 Gypsy Moth Catch Sites

OTHER INSECTS

BALSAM WOOLLY ADELGID

In 1996 balsam woolly adelgid populations continued to expand in northern Idaho. Infested acres estimated from aerial surveys has doubled from 1995 to over 24,000 acres in 1996. The figures for actual infested acres are probably higher because some areas are not yet displaying crown symptoms. Areas with the heaviest infestations occur on the St. Joe, Clearwater, and Nez Perce National Forest and adjacent State, private, and Bureau of Land Management land. Subalpine fir of all ages and size classes are killed. Extensive gouting and bole infestations occur on grand fir but only grand fir regeneration has suffered mortality. Mortality of both subalpine and grand fir regeneration is high, resulting in forest type conversions in some areas.

In 1997 balsam woolly adelgid populations continue to expand and intensify at many locations in northern Idaho. The estimated 56,300 acres infested in 1997, more than doubled the 24,000 acres recorded in 1996. Actual infested acres may be higher as some infested areas may not yet be displaying crown symptoms. Areas with the heaviest infestations occur on the St. Joe, Clearwater, and Nez Perce National Forests and adjacent State, private, and Bureau of Land Management lands. Subalpine fir of all ages and size classes are killed. Extensive gouting and bole infestations occur on grand fir but only small grand fir has been killed. Regeneration mortality of both subalpine and grand fir is high, resulting in forest type conversions in some areas. Continued surveys to delimit the distribution of the balsam woolly adelgid will continue in 1998. Damage assessment surveys are planned in the near future.

In 1998 balsam woolly adelgid populations remained high in areas infested, but the affected area remained at about the same level as recorded in 1997 in northern Idaho. Aerial survey data estimated nearly 56,300 acres infested in 1997. That figure declined slightly to 53,400 acres in 1998. Actual infested acres may be higher as some infested areas may not yet be displaying crown symptoms. Areas with the heaviest infestations occur on the St. Joe, Clearwater, and Nez Perce National Forest and adjacent State, private, and Bureau of Land Management land. Subalpine fir of all ages and size classes are killed. Extensive gouting and bole infestations occur on grand fir, but only grand fir regeneration in the grand fir type has suffered mortality. Regeneration mortality of both subalpine and grand fir is high, resulting in forest type conversions in some areas. Surveys to help delimit the distribution and assess damage caused by balsam woolly adelgid were begun in 1998. Additional damage assessment surveys will be conducted in 1999. In a few low elevation sites, where adelgid populations became established in the early 1980s, subalpine firs have virtually been eliminated.

BRACKEN FERN SAWFLY

In 1997 this sawfly, which pupates in the bark of ponderosa pine and feeds on Bracken fern, was found boring into ponderosa pine bark in the Scriver Creek drainage near Crouch, Idaho.

CONE AND SEED INSECTS

Cone and seed insects can cause considerable damage to the seeds of western conifers, significantly reducing seed crops. Though insects are found feeding on a variety of tree species in wild stands, they are especially of concern in blister rust-resistant western white pine seed orchards. Seed collected in these orchards is used to regenerate areas where white pine, once the dominant tree species, has nearly disappeared due to white pine blister rust.

The insects that cause the most damage in western white pine are western conifer seed bug, *Leptoglossus occidentalis*, cone beetle, *Conophthorus ponderosae*, and coneworm, *Dioryctria abietivorella*. One or more of these insects are usually so abundant in northern Idaho white pine seed orchards to warrant annual insecticide spray treatments. These insects have also been found destroying whitebark pine seed in high elevation stands. Whitebark pine is an important tree species for watersheds, wildlife, recreation, and aesthetics. This tree species has significantly declined in recent years due to blister rust, periodic outbreaks of mountain pine beetle, natural forest succession and fire suppression. Its seed is extremely valuable for wildlife and regeneration and may need to be protected from insect predation in the future.

Pheromone traps testing both attractants and anti-attractants for cone beetles were installed in the Forest Service Coeur d'Alene western white pine seed orchard in 1998. Tools for monitoring cone beetles are now available and anti-attractants show potential as a future management tool.

COOLEY SPRUCE GALL ADELGID

In 1996, 1997 and 1998 this adelgid was found in forested stands and ornamental trees throughout Idaho; impact is greatest on ornamental trees. On Douglas-fir, the alternative host, infested needles often develop a yellow spot and twist at the point of attack.

CRANBERRY GIRDLER MOTH

The larvae of cranberry girdler moths damage the roots of Douglas-fir and larch grown at the Coeur d'Alene Forest Service Nursery, making them unsuitable to plant. Populations can vary quite a bit each year so adult moths are routinely monitored with pheromone traps annually. When trap catches are high, fields are sprayed with Diazinon to kill adult moths in early summer and Dursban later in the summer to kill larvae. Damage estimates are determined during fall and spring lift and pack activities. With control measures, damage is often kept below 5%.

EUROPEAN PINE SHOOT MOTH

In 1998 this exotic shoot moth was found infesting ornamental pines in many counties in southwest Idaho. Severely infested trees developed deformities such as bushy appearance, spike tops and fork tops.

FALL WEBWORM

In 1998 localized populations of this defoliator were detected feeding on cottonwoods creating large spans of webbing, six feet or larger. Populations were most prevalent along water courses near Sandpoint, ID and also near St. Maries.

PACIFIC WILLOW LEAF BEETLE

This chrysomelid beetle identified as Pyrhalta decora carbo (LeConte) was reported heavily defoliating Scouler willow in the Palouse River Drainage in northern Idaho

PINE NEEDLE MINER

In 1998 approximately 600 acres of ponderosa pine in all size classes were discolored by a needle miner on the Emmett Ranger District on the Boise National Forest. Similar damage was observed on pines near Craigmont and Winchester, Idaho County, presumably caused by the same insect.

PINE SAWFLIES

In 1997 and 1998 defoliation of ponderosa pine caused by a sawfly was detected throughout the Little Weiser river drainage on the Payette National Forest.

POPLAR-AND-WILLOW BORER

In 1996, 1997 and 1998 the larvae of this weevil defoliated and caused stem mortality of Scouler willow on the west side of the Grand Teton Range in extreme southeastern Idaho.

SAGEBRUSH LEAF BEETLE

In 1996 heavy defoliation of sagebrush caused by a leaf beetle was detected on rangeland south of Twin Falls, Idaho. In 1997 and 1998 heavy defoliation was detected on rangeland south of Twin Falls, Idaho.

SATIN MOTH

In 1997 heavy defoliation of willow caused by the larvae of the satin moth was detected near Donnelly.
In 1998 caterpillars of this moth were reported defoliating many different hardwoods along river drainages near Sandpoint and Wallace, Idaho.

TENT CATERPILLAR

In 1998 caterpillars of this moth were reported defoliating many different hardwoods along river drainages near Sandpoint and Wallace, Idaho.

XYELID SAWFLY

In 1997 and 1998 localized populations of this sawfly were detected feeding on pine pollen in the Boise River drainage on the Boise National Forest.

FOREST DISEASES

STEM AND BRANCH DISEASES

COMANDRA BLISTER RUST

This disease occurs infrequently on lodgepole and ponderosa pine throughout Idaho. Localized areas of heavy infection resulting in branch, top, and entire tree mortality of sapling-size ponderosa pine occurs in offsite plantations in southern Idaho.

PINYON BLISTER RUST

This disease occurs on pinyon pine in the Raft River Mountains on the Sawtooth National Forest in central Idaho. Disease levels are generally sporadic and tree mortality is low.

STALACTIFORM BLISTER RUST

This rust disease occurs on lodgepole pine in localized areas throughout Idaho. Severe infection has occurred in localized areas on the Boise, Payette, Sawtooth and Targhee National Forests.

WESTERN GALL RUST

This disease occurs throughout the range of lodgepole and ponderosa pine in Idaho. Disease levels vary from year to year; some sites are more prone to damage from this disease than others. Individual tree resistance to this disease is common; in some locations where most trees are infected, individuals may not display disease symptoms. Generally the disease is not an important cause of mortality, although branch and stem breakage can be of concern, especially within recreation areas. Gall rust is an important consideration in tree improvement plantations where infection can significantly affect performance of young trees.

WHITE PINE BLISTER RUST

White pine blister rust is caused by the pathogen *Cronartium ribicola* which was introduced into western North America about 1910, and subsequently spread to western white pine, whitebark pine and limber pine in Idaho and other western forests. The disease drastically reduced amounts of western white pine that was once the predominant forest tree species on about 5 million acres in northern Idaho. This epidemic has subsided during the past few decades, primarily due to extensive losses of host populations. The pathogen continues to kill seedlings that naturally regenerate from remaining white pine trees, and, in collaboration with mountain pine beetle, continues to kill residual mature trees. Rust-resistant white pine seedling stock, which has been produced from an intensive breeding program, is widely planted in northern Idaho. Blister rust is an important mortality factor on both whitebark and limber pine. This disease has caused decline of these important high-elevation species. Efforts are underway to regenerate whitebark pine in areas where blister rust has caused extensive mortality.

CANKER DISEASES

ATROPELLIS CANKER

This canker occurs on lodgepole pine and is usually found in groups of pole-sized trees. This disease primarily causes stem defects and topkill; tree mortality is infrequent. The disease is common in certain stands, but totally absent from others.

CYTOSPORA CANKER

This disease occurs at some level on all *Abies* spp. Infected trees display branch flagging, top killing, and infrequent mortality. The disease is associated with environmental stresses such as drought, frost, and freezing damage. Severely-infected trees may often be killed by the western balsam bark beetle.

DIPLODIA (SPHAEROPSIS) BLIGHT

This disease is very common on ponderosa pine in many areas throughout Idaho. Damage occurs primarily as a branch or main stem dieback with dead branch tips especially common on exposed portions of tree crowns. Affected trees are often found in riparian areas, although damage can occur on the edges of any ponderosa pine stand. Apparently, disease severity is cyclic and associated with years of prolonged cool, wet weather. This disease does not cause tree mortality (except in nursery seedlings) but results in trees with dieback symptoms that may be especially unsightly in recreational and residential areas.

STEM DECAYS

ASPEN TRUNK ROT

Decay caused by this fungus occurs most frequently in aspen stands in southern Idaho; damage seems to increase in stands greater than 80 years old.

INDIAN PAINT FUNGUS (RED-STRINGY ROT)

This fungus is an important cause of heartwood decay of hemlock and *Abies* spp. It causes more than 90% of the decay occurring in these species and is especially damaging in trees greater than 60 years of age. Although decay can occur throughout the range of susceptible species, the most extensive damage occurs in areas where trees are exposed to prolonged periods of cool, wet conditions, particularly in stands with stagnant moist air. Such stands often occur near water (streams and lakes) and in valley bottoms.

RED RING ROT (WHITE POCKET DECAY)

This important fungus causes white pocket decay on western larch and pine; it occurs less frequently on spruce, Douglas-fir and *Abies* spp. Heartwood decay is produced on mature trees; damage levels vary considerably throughout Idaho.

RUST-RED STRINGY ROT

Decay caused by this fungus is common in mature and overmature stands of *Abies* spp. throughout southern Idaho.

ROOT DISEASES

With the losses of white pine due to blister rust, root diseases have become the most important diseases in northern Idaho. Primary hosts of root diseases (Douglas-fir and *Abies* spp.) have increased greatly during the past several decades with the loss of western white pine, western larch and ponderosa pine in mixed stands due to blister rust, fire control, and logging. The most important root pathogens in Idaho are *Phellinus weirii* (cause of laminated root disease) and *Armillaria ostoyae* (cause of Armillaria root disease). Many root pathogens are intimately associated with insects (particularly bark beetles) either as vectors or agents that attack and often kill infected trees. Therefore, mortality levels may vary from year to year in response to bark beetle activity.

ANNOSUS ROOT DISEASE

Heterobasidion annosum is an important root pathogen in some forest stands throughout Idaho. It causes two types of disease: direct mortality of pine (particularly ponderosa pine) and decay of *Abies* spp. and Douglas-fir. Infected trees are frequently found near stumps, which serve as inoculum sources. Importance, distribution, and impact of this root disease varies widely throughout Idaho.

ARMILLARIA ROOT DISEASE

Although several species of *Armillaria* occur throughout Idaho's forests, the most important pathogen is *A. ostoyae*. This fungus attacks and kills conifers of all ages, but prefers Douglas-fir and *Abies* spp. Young pine and larch may also be killed, particularly within plantations. In northern Idaho, *Armillaria* is often an aggressive pathogen in many forest stands; in southern Idaho, it is usually a weak pathogen or saprophyte causing little direct mortality unless present in complexes with other root-pathogenic fungi.

BLACK STAIN ROOT DISEASE

Black stain root disease is caused by the fungus *Leptographium wagneri* and is found infrequently in Idaho. The pathogen may cause pinyon pine mortality (associated with insect attacks) in southern Idaho and occurs on ponderosa pine in some stands in northern Idaho. The fungus is vectored by root-feeding bark beetles and infected trees are invariably attacked and killed by other bark beetles.

LAMINATED ROOT DISEASE

This important root pathogen is a major cause of mortality of Douglas-fir and *Abies* spp. in northern Idaho. It causes damage to trees of all ages, primarily in groups. Losses in some areas are extensive, although distribution of the pathogen within forests varies widely. Some level of disease-associated mortality occurs each year with greater mortality occurring during years when drought stresses infected trees or influences associated bark beetle populations.

SCHWEINITZII ROOT DISEASE (BROWN CUBICAL ROOT AND BUTT ROT)

Phaeolus schweinitzii causes brown-cubical decay of roots and butts of Douglas-fir and pine species (particularly ponderosa pine). This fungus is a common root inhabitant of Douglas-fir trees of all ages, but causes root decay mostly in mature trees. Trees on poor sites (shallow soils with poor water-holding capacity) are especially prone to damage by this fungus. Infected trees are rarely directly killed by this fungus, but predispose trees to windthrow and bark beetle attacks.

TOMENTOSUS ROOT DISEASE

This disease occurs on Douglas-fir, subalpine fir, Engelmann spruce and lodgepole pine. The pathogen usually causes root and butt decay, often in association with other root-infecting fungi. Pole-sized or larger trees are infected; many of these are predisposed to bark beetle attack and windthrow. The pathogen is most common in southern Idaho, but occurs at low levels throughout the state.

WHITE MOTTLED ROT

This root pathogen of aspen is increasing throughout southern Idaho. The disease is frequently found on windthrown trees on the Caribou and Sawtooth National Forests.

DWARF MISTLETOES

Dwarf mistletoes are parasitic seed plants in the genus *Arceuthobium*; they occur on most conifer species in Idaho. In particular, Douglas-fir, western larch, ponderosa and lodgepole pine are seriously infected in certain areas. Western larch overstory trees throughout many stands in northern Idaho are extensively infected with dwarf mistletoe. Douglas-fir and ponderosa pine are infected only in particular stands in northern Idaho. Lodgepole pine dwarf mistletoe is especially damaging in southern Idaho. Suppression projects have continued to remove infected overstory trees. However, dwarf mistletoes remain very widespread and probably are the most damage by disease in southern Idaho.

FOLIAGE DISEASES

Foliage diseases occur on most conifer species and damage in Idaho varies from year to year. Although damage varies, in some cases, such as Elytroderma needlecast, infection occurs year after year. Foliage diseases usually only reduce tree growth and very rarely cause tree mortality. However, they may be important problems in Christmas tree and tree improvement plantations where healthy foliage is required. In these cases, direct suppression with fungicides is often warranted.

CEDAR APPLE RUST

In eastern Idaho, this disease is caused by *Gymnosporangium* sp.; it causes a leaf spot on residential apple trees in Challis and Salmon, Idaho and to *Amelanchier* spp. throughout the range of serviceberry in eastern Idaho.

CONIFER-ASPEN RUST (CONIFER-COTTONWOOD RUST)

In 1996, an epidemic of this rust disease occurred throughout the range of *Populus* spp. in southern Idaho. In 1997, the fungus was not observed on its main conifer host (Douglas-fir); it is possible that the fungus overwintered on its *Populus* hosts due to mild winters. In 1998, disease occurrence was light, probably because of competition with other foliage diseases related to late frosts.

ELYTRODERMA NEEDLECAST

Elytoderma deformans causes a locally systemic needlecast disease of ponderosa pine. In 1996, high levels of infection were noticed throughout many stands in Idaho. Infection was especially severe on the Salmon National Forest where foliage discoloration was noted on more than 9500 acres. In 1997 and 1998, relatively high levels of infection again occurred throughout the state.

FIR BROOM RUST
This disease is widespread throughout Idaho. Although the disease is usually of little consequence, high disease levels occur in some stands south of the Snake River in southern Idaho.

LARCH NEEDLE DISEASES
Larch needlecast is caused by *Meria laricis* and needleblight is caused by *Hypodermella laricis*. Both diseases are generally cyclical, occurring at high levels during years of prolonged cool, moist weather in the spring and early summer. In 1996, these diseases were epidemic throughout central Idaho; they were apparently associated with a late June frost. More than 88,000 acres were damaged on the Payette and northern portions of the Boise National Forests. However, disease incidence in 1997 and 1998 declined, primarily due to increased defoliation by larch casebearer.

LODGEPOLE PINE NEEDLECAST
Lophodermella concolor causes cyclic damage on lodgepole pine throughout Idaho. In southern Idaho, the disease appears following periods of drought. In northern Idaho, extensive damage is evident in the early spring in some stands. Although damage varies from year to year, it is difficult to predict future disease levels based on observations of spring weather conditions. High levels of infection make trees appear extensively damaged. However, the disease usually only reduces growth and has no prolonged effects on infected trees. An exception is in tree improvement plantations where growth reductions seriously affect tree performance.

MISCELLANEOUS FOLIAGE DISEASES
Fir needlecast on subalpine and grand fir occurred at low levels from 1996-1998 throughout Idaho. Ponderosa pine needle rust occurred at light to moderate levels. Red band needle blight remained at fairly high intensity on ponderosa pine in some locations, such as along the Lochsa River in northern Idaho. White pine needlecast has declined dramatically during the past few years. Marssonina blight (Shepard's Crook) occurred at epidemic proportions during 1996-1998 in central and eastern Idaho. Affected trees had brown-colored foliage from mid-July until leaf drop in the fall.

RHABDOCLINE NEEDLECAST
This disease occurs on young Douglas-fir throughout Idaho; it is particularly noticeable in some stands in northern Idaho and may cause extensive defoliation on young trees. Christmas tree production has been greatly reduced or eliminated in certain parts of northern Idaho because of this disease.

SPRUCE BROOM RUST
This disease is scattered throughout spruce stands in Idaho. It appears most common in certain stands in eastern Idaho.

SWISS NEEDLECAST
This is another foliage disease of Douglas-fir that occurs throughout northern Idaho. In recent years, infection levels have increased, probably because of increasing fungal inoculum and conducive spring weather. Affected trees appear yellow with little previous years' needle retention.

NURSERY DISEASES

The most important diseases of conifer seedling nursery stock in Idaho are caused by *Fusarium* spp. *Fusarium oxysporum* and *F. proliferatum* are the most important disease-causing *Fusarium* species in bareroot and container nurseries, respectively. Both pathogens cause damping-off of young germinants and root diseases of older seedlings. Other important root pathogens include *Cylindrocarpon* spp. (especially on container-grown western white pine), *Pythium* spp., *Phytophthora* spp., and sometimes *Rhizoctonia solani*. *Botrytis cinerea* is an important foliar pathogen on most conifer species; western larch and Engelmann spruce are especially susceptible. *Meria laricis* often causes serious needlecast disease on bareroot western larch seedlings in northern Idaho. Other important pathogens of conifer seedlings include *Sphaeropsis sapinea, Sirococcus strobilinus* and *Phoma eupyrena*, all causing tip dieback diseases, especially on *Pinus* spp. Recent efforts to develop alternatives to pre-plant soil fumigation with methyl bromide/chloropicrin have resulted in higher disease levels caused by soilborne pathogens in some Idaho nurseries. Alternative chemical fumigants (dazomet) and other soil treatments (organic amendments, fallowing, solarization, biological control agents, *Brassica* green manure crops) are being evaluated for efficacy in replacing methyl bromide. Until satisfactory alternatives are available for each nursery, disease losses higher than in the past can be expected.

ABIOTIC DISEASES

On November 19, 1996, a severe winter storm passed through northern Idaho, producing freezing rain in lower elevations and heavy snow at higher elevations. The ice buildup caused millions of dollars of damage in urban areas as trees and power poles were broken and uprooted in a 30-mile area from Spokane, Washington to Wallace, Idaho.

Evaluations estimated that 10-20 million board feet of timber was affected. Park and recreation areas along Lake Coeur d'Alene were severely damaged; nearly 300,000 board feet of timber was salvaged from 80 acres of Tubb's Hill, a park managed as a natural area near downtown Coeur d'Alene. The ice was followed by several unusually wet snowstorms that caused many roofs to collapse in several northern Idaho communities and also caused additional storm damage in forests throughout the region.

STATUS OF CHRONIC DISEASE PROBLEMS

DISEASE	HOST	LOCATION/REMARKS
STEM & BRANCH DISEASES		
Aspen trunk rot	Aspen	Decay occurs in most aspen stands in southern Idaho and is increasingly common as aspen stands exceed 80 years of age.
Atropellis canker	Lodgepole pine	Found in pockets in pole sized stands causing defect, topkill, and some mortality.
Comandra blister rust	Lodgepole pine/ponderosa pine	Infection occurs infrequently throughout Idaho. Heavy, localized areas of infection resulting in branch, top, and entire tree mortality of sapling-size ponderosa pines occurs in offsite plantations on southern Idaho.
Cytospora canker	True firs	Branch flagging, top killing, and mortality attributed to this fungus occurs wherever host is found. This disease is associated with environmental stress damage, drought, frost, and freezing. Western balsam bark beetles frequently kill the diseased trees.
Diplodia blight (Sphaeropsis blight)	Ponderosa pine	Is causing widespread branch dieback in many Idaho areas; especially common in riparian areas.
Dwarf mistletoes	Douglas-fir, western larch, lodgepole and ponderosa pine	Suppression projects continue to remove infected overstory trees; however this forest disease remains the most widespread and damaging throughout the state.
Indian paint fungus (Rusty-red stringy rot)	True firs, hemlock	Causes 90 percent of decay in these species throughout the state; especially common as age increases beyond 60 years.
Pinyon blister rust	Pinyon pine	This disease occurs in the Raft River Mountains on the sawtooth National Forest
Red ring rot	Western larch, true firs, Douglas-fir, pines, spruce	Can cause serious decay problems in mature conifers. Infection intensity varies throughout host stands in southern Idaho.
Rust-red stringy rot		Decay caused by this fungus is common in mature and overmature stands of true firs throughout southern Idaho.
Stalactiform blister rust	Lodgepole pine	This rust occurs in localized areas throughout the host type. Heavy infection has been in very localized areas of the Boise, Payette, Sawtooth, and Targhee NF's.
Western gall rust	Lodgepole and ponderosa pine	Gall rust occurs throughout the host types. Infection levels vary, with localized heavy infection present in both host species.
White pine blister rust	Western white pine, limber pine, whitebark pine	This introduced disease is common throughout its host ranges in Idaho. A formal survey of five-needled pines was conducted in 1995-1997 in southern Idaho to quantify disease incidence and intensity, and determine site and stand characteristics of infected areas. An interim report is forthcoming.
ROOT DISEASES		
Annosus root disease	Pines, true firs, Douglas-fir, spruce	Causes mortality, root and butt rot especially in young trees near old stumps; frequently in complexes with other root diseases; may predispose trees to windthrow and/or bark beetles. This root disease fungus can be found throughout southern Idaho, but mostly as a decay organism. The fungus is occasionally damaging to young, planted stands of ponderosa pine on droughty soils.
Armillaria root disease	Douglas-fir, grand fir, other conifers especially when young and improperly planted	In northern Idaho, a widespread killer of all sizes of trees; In southern Idaho usually found as a weak pathogen or saprophyte causing little direct mortality or in complexes with other root diseases.
Black stain root disease	Pines, Douglas-fir	Found infrequently in Idaho; caused pinyon pine mortality in southern Idaho; usually in association with other root diseases.

Laminated root rot	Douglas-fir, true firs, occasionally other conifers	Primary killer in many stands from the Nez Perce NF north; may be found with Armillaria or other root diseases.
Schweinitizii root rot	Douglas-fir, pines	This decay is common in mature and overmature forests throughout the host type, especially those with a frequent fire or logging history. The fungus is often associated with other root pathogens and bark beetle activity..
Tomentosus root disease	Douglas-fir, subalpine fir, Engelmann spruce, lodgepole pine	Usually found as root/butt rot with other root diseases; occasionally causes mortality. It causes root and butt rot of pole seized and larger trees, predisposing them to bark beetle attack and windthrow. Most common in southern Idaho, but present throughout the state.
White mottled rot	Aspen	This pathogen is increasing in incidence throughout southern Idaho. The disease can be found on windthrown aspen on the Caribou and Sawtooth National Forest.
FOLIAGE DISEASES		
Cedar apple rust	Juniper, Apple, Serviceberry	In eastern Idaho, this disease caused by an unknown species of *Gymnosporangium*, **caused a leaf spot on residential apple trees in Challis and Salmon, ID and to** ***Amelanchier*** **throughout the range of serviceberry in eastern Idaho.**
Conifer-Aspen rust Conifer-Cottonwood rust	Aspen, cottonwood, conifers	In 1996 epidemic throughout the host range of all **Populus** species. **In 1997 the fungus has not been observed recently on main conifer host, Douglas-fir, so it may be overwintering on** ***Populus*** **due to mild winters. In 1998 occurrence was light due to late frost competition with other foliage diseases.**
Rhabdocline needlecast	Douglas-fir	Very widespread but relatively light levels statewide.
Swiss needlecast	Douglas-fir	Widespread in northern Idaho; generally at very low levels of infection.
Elytroderma needlecast	Ponderosa pine	In 1996 systemic and annual infections occur throughout the host type. Infection was especially severe on the Salmon National Forest where foliage discoloration was noted on over 9,500 acres. In 1997 and 1998 systemic and annual infections occur throughout the host type.
Fir broom rust	True firs	Widespread throughout the state; usually of little consequence, but is "extremely common" in stands south of the Snake River in southern Idaho.
Fir needlecast	Subalpine fir Grand fir	Infection occurred at low levels throughout the host type.
Fir needle rust	Subalpine fir	Scattered infection occurs on seedlings and sapling trees throughout the host type.
Larch needle disease	Larch	In 1996 incidence and severity of infection in west central Idaho is cyclical. These diseases were epidemic over the host range following a late frost in June. Over 88,000 acres of damage was found on the Payette and northern Boise National Forest. Incidence and severity of infection in west central Idaho is cyclical. In 1997 and 1998 these diseases were overshadowed by larch defoliation caused by the larch casebearer.
Lodgepole pine needlecast	Lodgepole pine	Infection intensity is worse following periods of drought. During intervening years, the disease is of minor localized importance.
Marssonina blight Shepard's Crook	Aspen	In 1996 -1998 the disease was epidemic in central and eastern Idaho. Affected trees had brown colored foliage from mid-July until leaf drop.
Pine needle rust	Pines	Scattered incidence of light to moderate intensity scattered throughout the host types in southern Idaho.
Spruce broom rust	Engelmann spruce	Scattered through host range; most common in eastern Idaho.
White pine needlecast	Western white pine	Infections declined dramatically.

NURSERY DISEASES		
Cylindrocarpon	Western white pine whitebark pine	Common in soil or contaminated containers, usually a saprophyte but may be a weak parasite, caused losses at several nurseries.
Diplodia tip blight	Pines	Low levels in areas with a history of problems.
Fusarium root disease	Douglas-fir, larch, spruce, others	The most common and widespread nursery disease; amount of damage varies widely. This disease causes small amounts of mortality primarily of 1-0 conifer seedlings at the Lucky Peak Nursery in Southern Idaho.
Grey mold	most conifers, esp. larch, spruce	Common at low levels in many nurseries. Can be a serious storage problem.
Meria needlecast	Larch	Infection levels are very low.
Phoma blight	Pines	Commonly isolated from seedlings and soil samples.
Phytophthora/Pythium root rot		These fungi occur infrequently on seedlings and in soil at Lucky Peak Nursery in Southern Idaho. Infection results in patch mortality and culling of 2-0 seedlings.
Sirococcus tip blight	spruce, pines	Found at low levels at several nurseries.

COMMON AND SCIENTIFIC NAMES OF INSECTS

Balsam woolly adelgid	*Adelges picea* (Ratzburg)
Black-headed budworm	*Acleris gloverana*
Boxelder leafroller	*Caloptilia negundella* (Chambers)
California five-spined Ips	*Ips paraconfusus* Lanier
Cone feeding adelgid	*Pineus coloradensis* (Gillette)
Cone moth	*Eucosma recissoriana* Heinrich
Cone worms	*Dioryctria* spp.
Cranberry girdler moth	*Chrysoteuchia topiaria* (Zeller)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopk.
Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
Fir engraver	*Scolytus ventralis* LeConte
Gypsy moth	*Lymantria dispar* (L.)
Lodgepole terminal weevil	*Pissodes terminalis* Hopping
Lodgepole needleminer	*Coleotechnites milleri* Busck
Mountain pine beetle	*Dendroctonus ponderosae* Hopk.
Pine engraver	*Ips pini* (Say)
Pine needle sheath miner	*Zelleria haimbachi* Busck
Red turpentine beetle	*Dendroctonous valens* Le Conte
Rusty tussock moth	*Orgyia antiqua* (L.)
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Tip moth	*Rhyacionia zozara* (Kearfott)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western conifer seedbug	*Leptoglossus occidentalis* Heidmann
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western pine shootborer	*Eucosma sonomana* Kearfott
Western spruce budworm	*Choristoneura occidentalis* Freeman

COMMON AND SCIENTIFIC NAMES OF DISEASES

Annosus root disease	*Heterobasidion annosum* (Fr.) Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Atropellis canker	*Atropellis piniphila* (Weir) L. & H.
Black stain root disease	*Leptographium wagneri* (Kendr.) Wingf.
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra blister rust	*Cronartium comandrae* Pk.
Conifer-Aspen rust	*Melampsora medusae* Thum.
Conifer-cottonwood rust	*Melampsora occidentalis* Jacks.
Cylindrocarpon root disease	*Cylindrocarpon* spp.
Cytospora canker of firs	*Cytospora abietis* Sacc.
Diplodia tip blight	*Sphaeropsis sapinea* (Fr.) Dyko
Dutch elm disease	*Ceratocystis ulmi* (Buism.) C. Mor.
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needlecast	*Elytroderma deformans* (Weir) Dark.
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.
Fir needlecast	*Lirula abietis-concoloris* (Mayr:Dearn) Darker
Fir needle rust	*Pucciniastrum epilobii* Otth
Fusarium root disease	*Fusarium* spp.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Indian paint fungus	*Echinodontium tinctorium* (Ell.& Ev.) Ell. & Ev.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Larch needle blight	*Hypodermella laricis* Tub.
Larch needlecast	*Meria laricis* Vuill.
Lodgepole pine needlecast	*Lophodermella concolor* (Dearn.) Dark.
Marssonina blight	*Marssonina populi* (Lib.) Magn.
Phoma blight	*Phoma* spp.
Pine needle rust	*Coleosporium sp.*
Pythium root disease	*Pythium ultimum* Trow.
Red ring rot	*Phellinus pini* Pilat.
Rhabdocline needle cast	*Rhabdocline pseudotsugae* Syd. *Rhabdocline weirii* Parker & Reid
Schweinitzii root/butt rot	*Phaeolus schweinitzii* (Fr.) Pat.

Shepard's crook	*Venturia macularis* (Fr.) E.Muller & Von Arx
Sirococcus tip blight	*Sirococcus strobilinus* Preuss.
Stalactiform rust	*Cronartium coleosporioides* (Diet. & Holw.) Arth.
Spruce broom rust	*Chrysomyxa arctostaphyli* Diet.
Spruce mottled needlecast	*Rhizosphaeria kalkhoffii* Bud.
Swiss needle cast	*Phaeocryptopus gaeumannii* (Rhode) Pet.
Tomentosus root disease	*Inonotus tomentosus* (Fr.) Gilb.
Western gall rust	*Endocronartium harknessii* (Moore) Hir.
White pine blister rust	*Cronartium ribicola* Fisch.
White pine needlecast	*Lophodermella arcuata* (Darker) Darker

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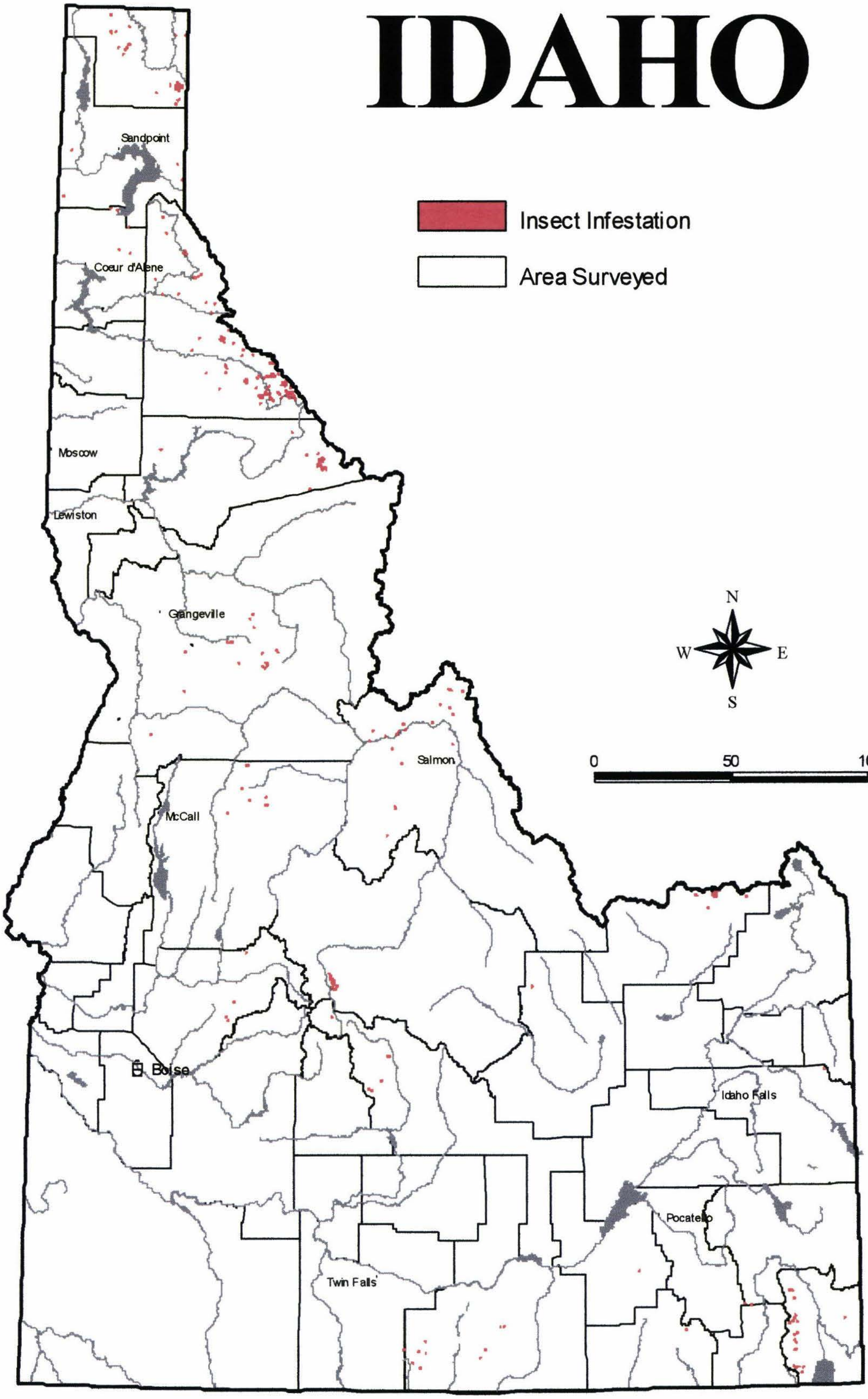
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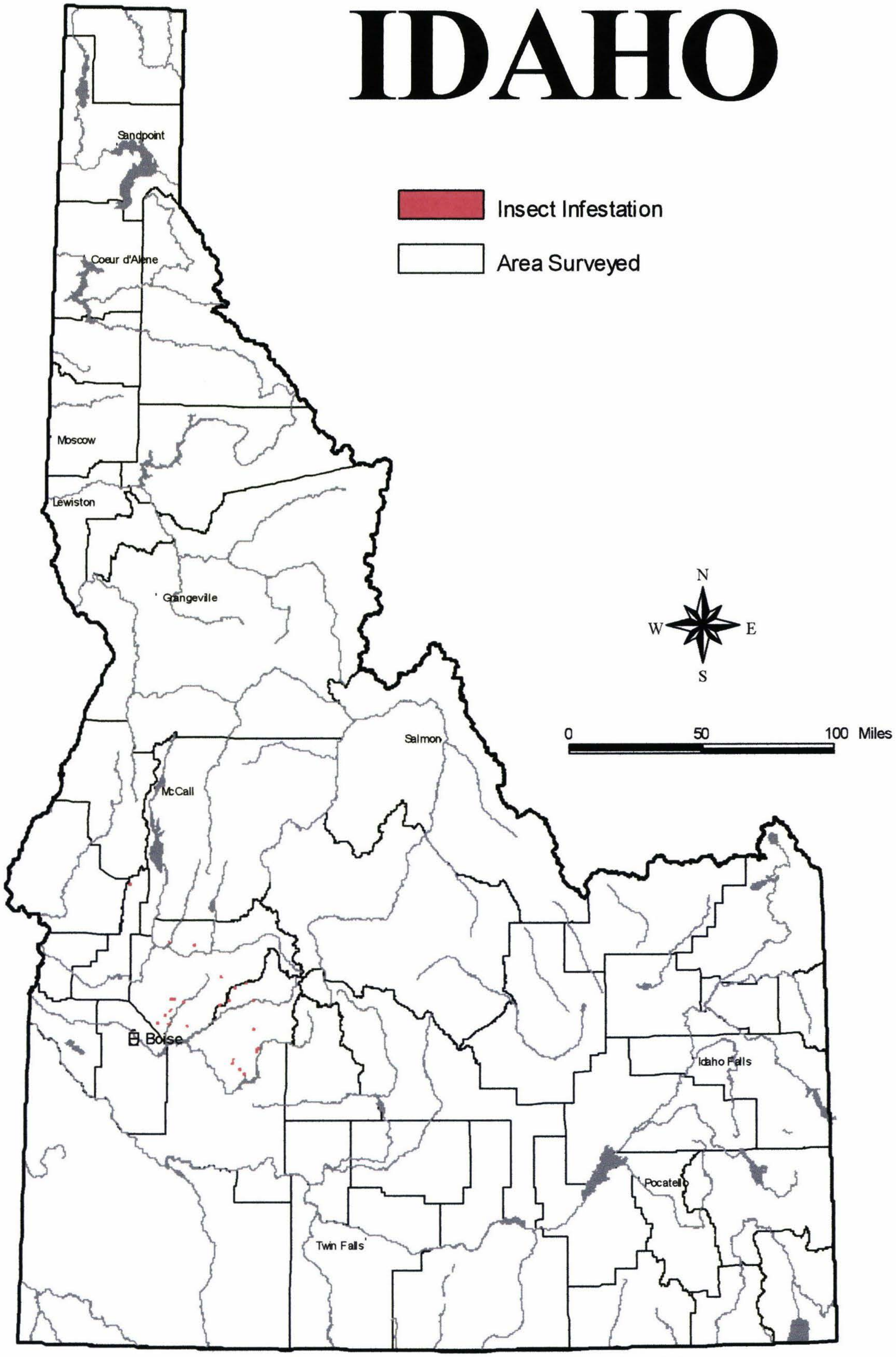
Map 96-1 Areas of Mountain pine beetle infestations in Idaho in 1996.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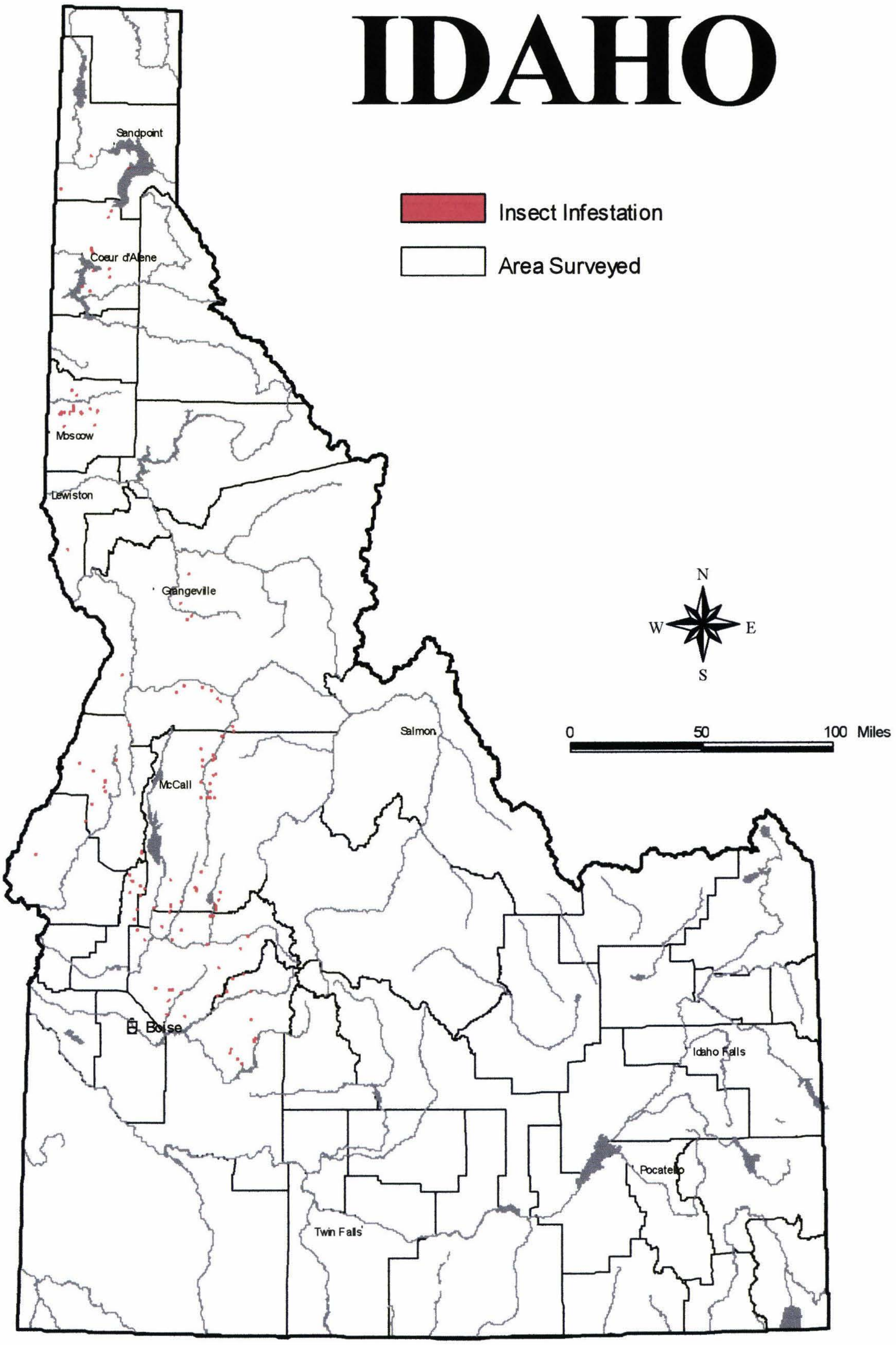
Map 96-2 Areas of Pine engraver beetle infestations in Idaho in 1996.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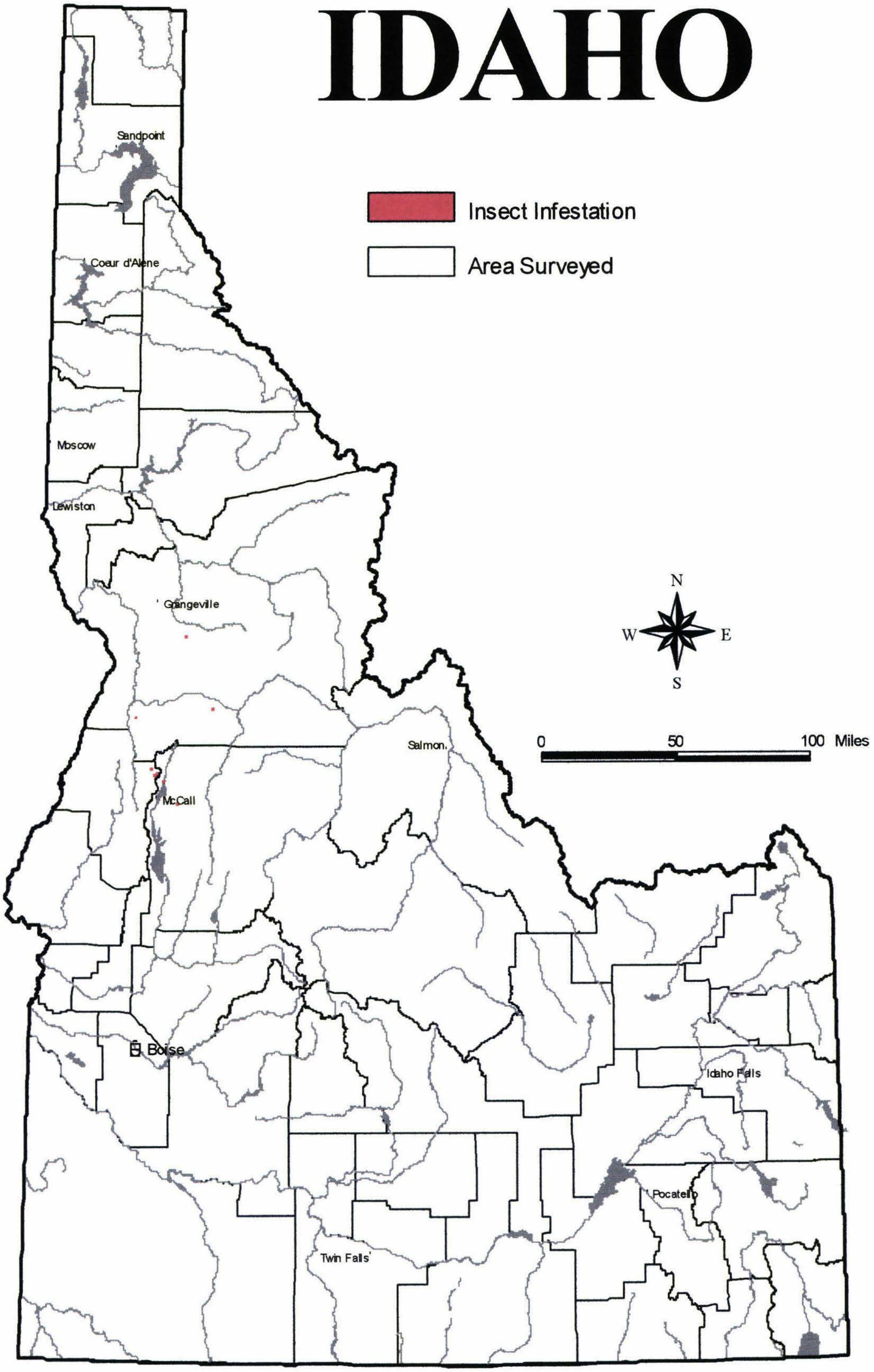
Map 96-3 Areas of Western pine beetle infestations in Idaho in 1996.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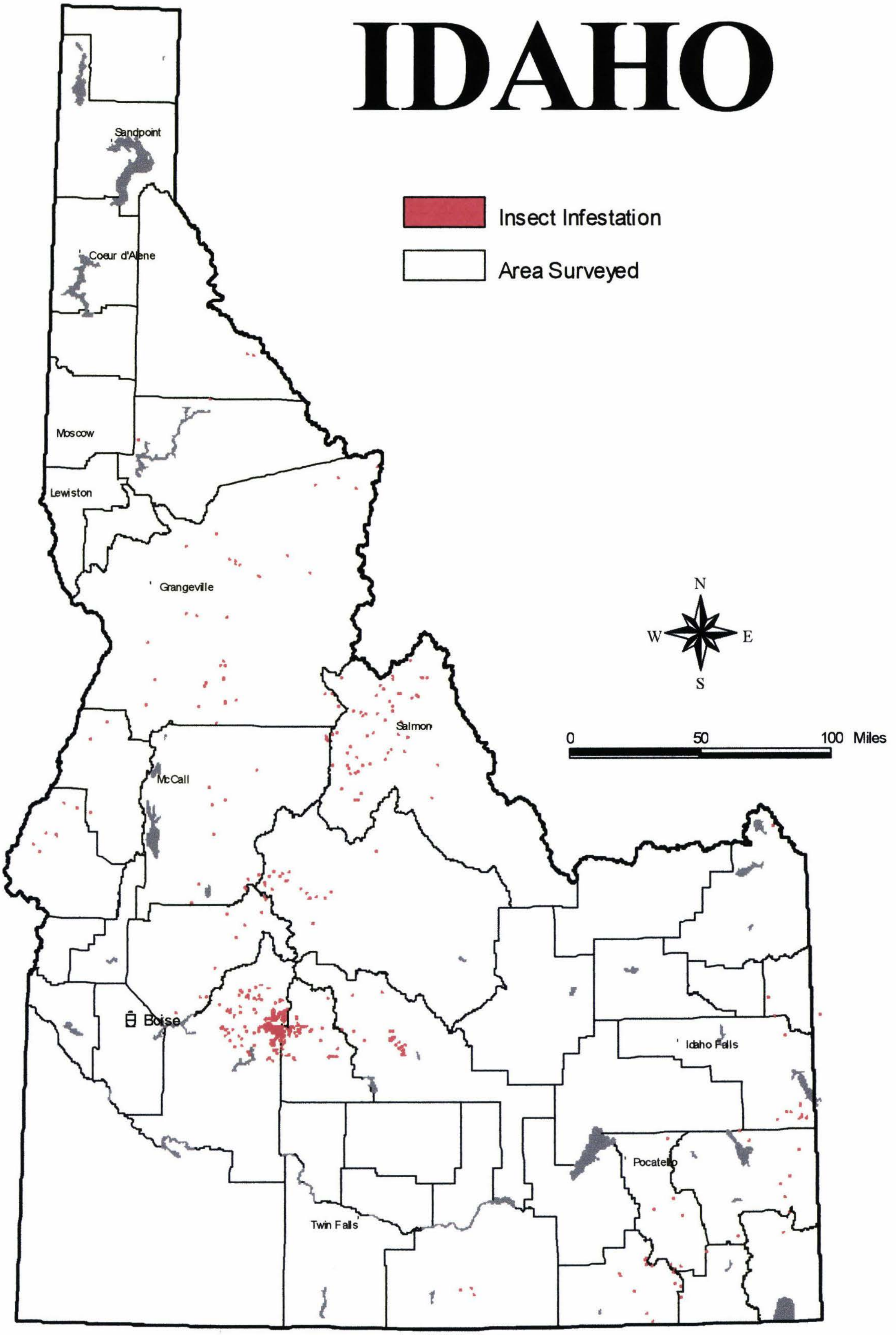
Map 96-4 Areas of Spruce beetle infestations in Idaho in 1996.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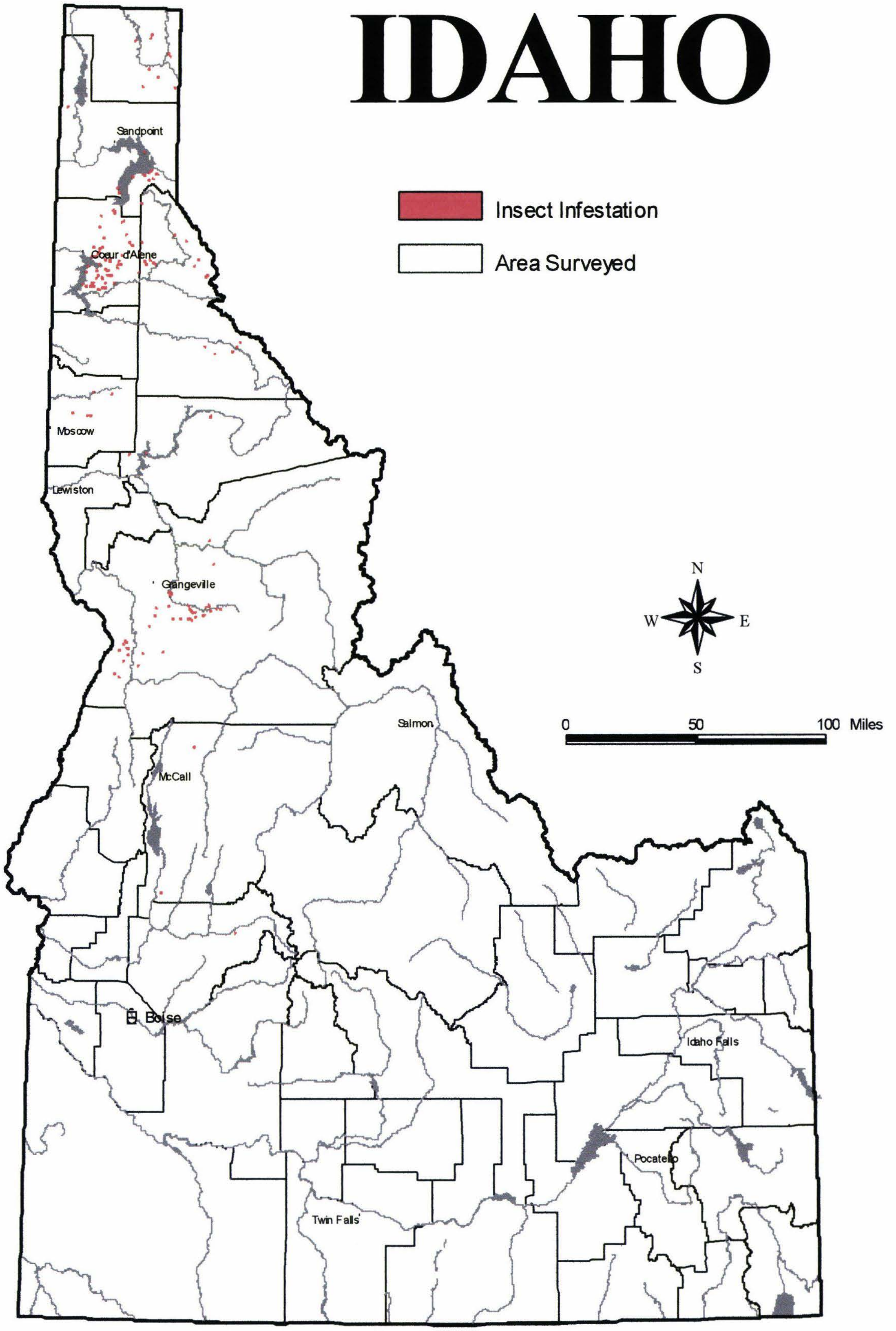
Map 96-5 Areas of Douglas-fir beetle infestations in Idaho in 1996.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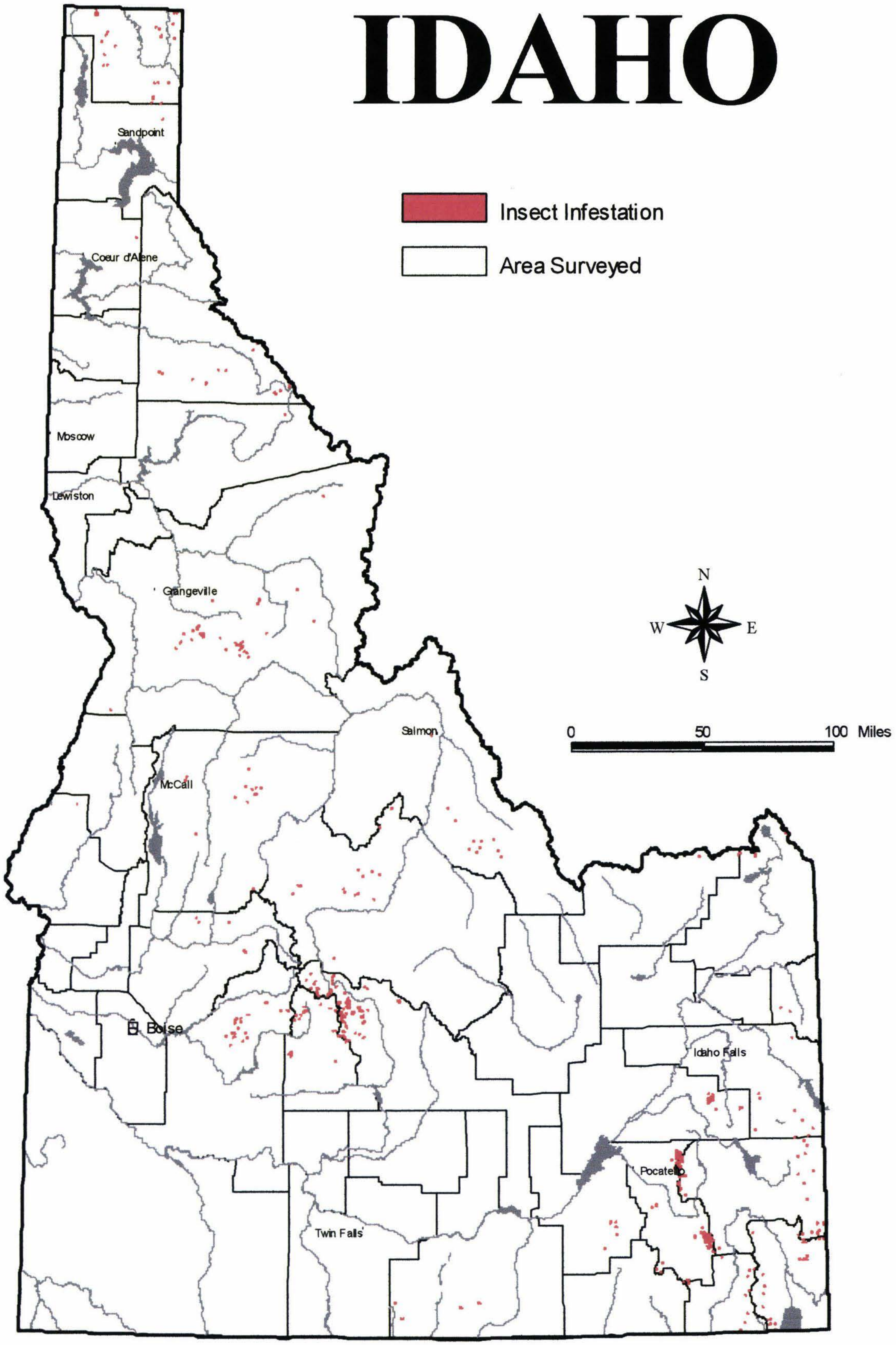
Map 96-6 Areas of Fir engraver beetle infestations in Idaho in 1996.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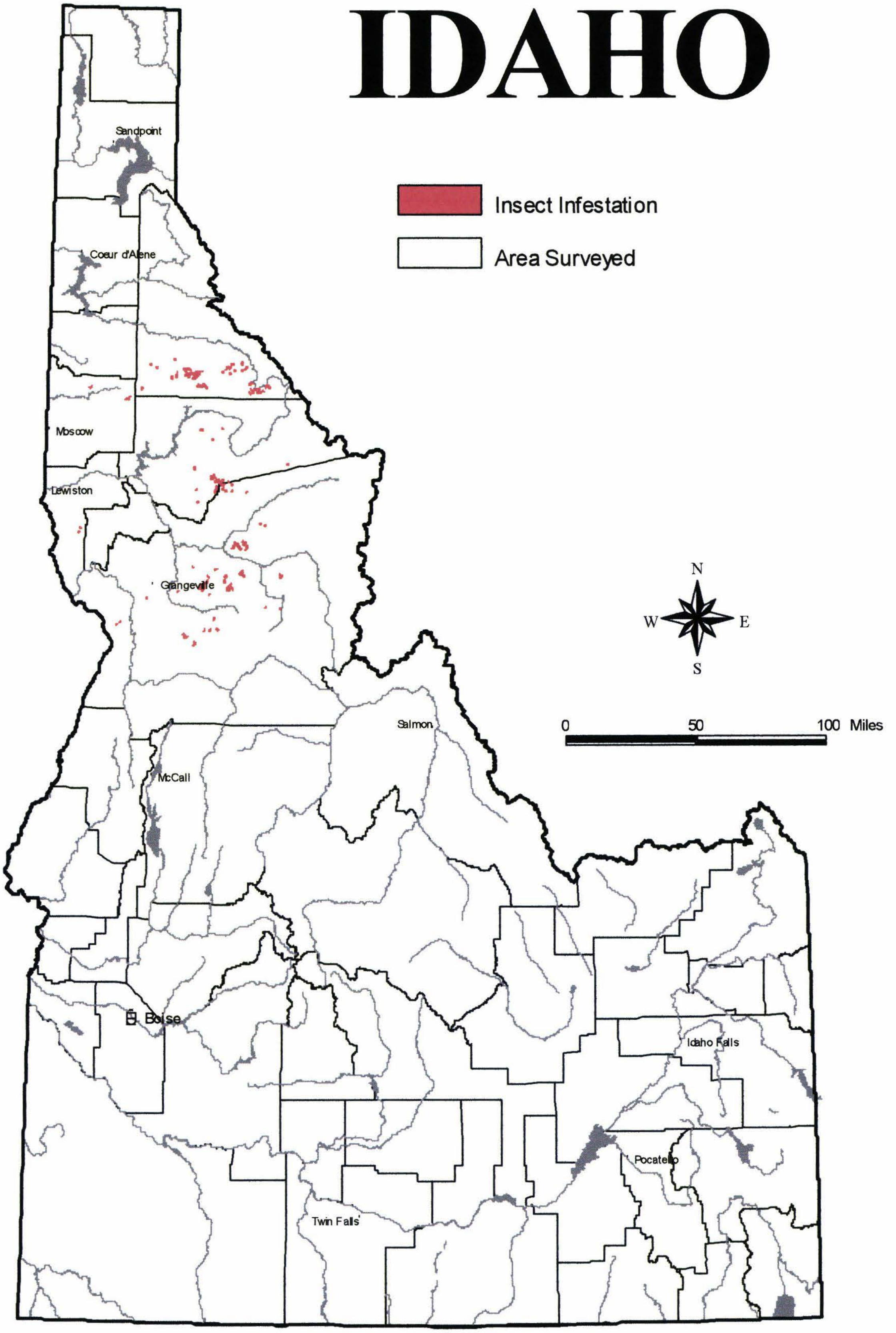
Map 96-7 Areas of Western balsam bark beetle infestations in Idaho in 1996.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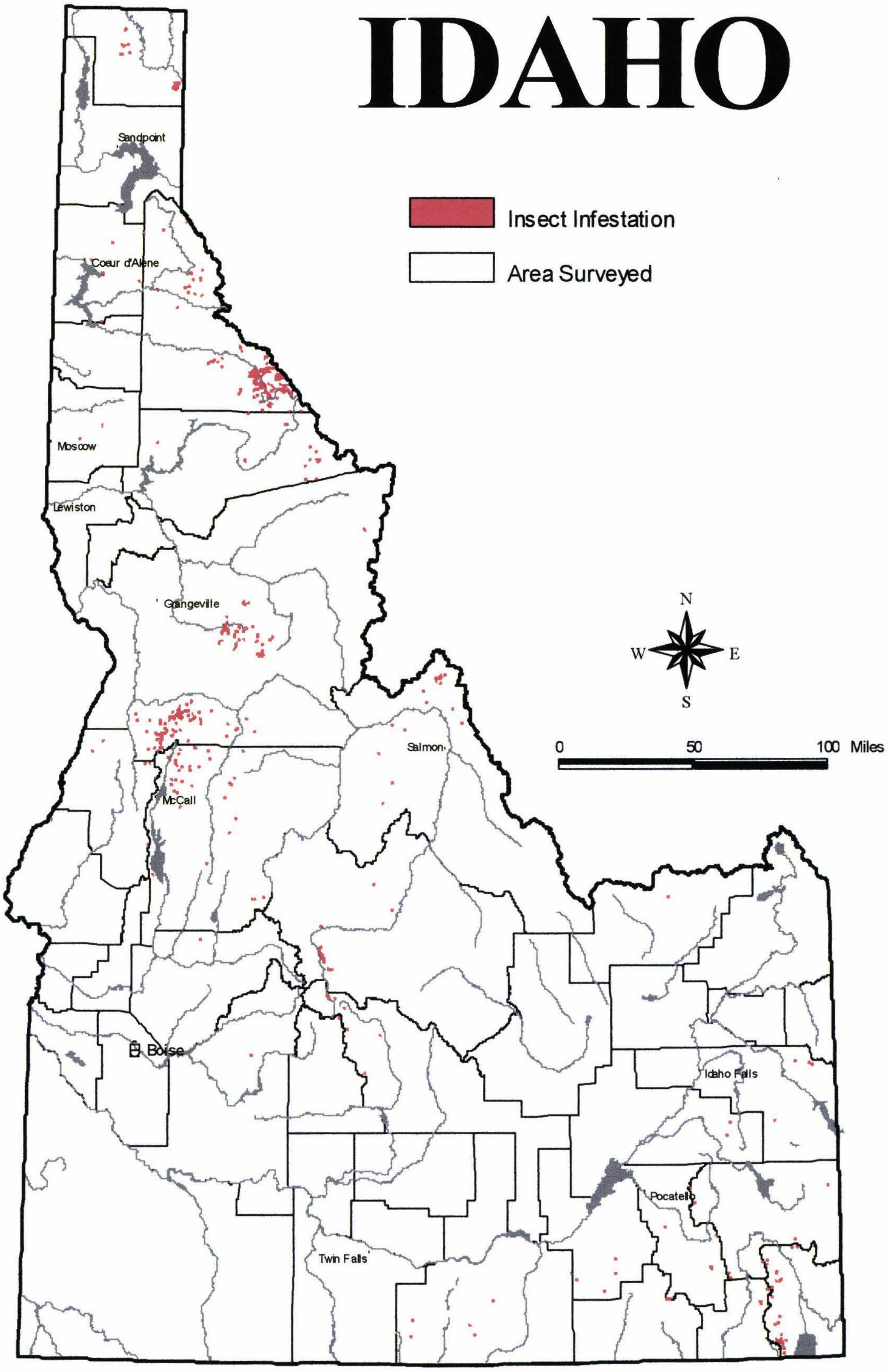
Map 96-8 Areas of Balsam Woolly Adelgid infestations in Idaho in 1996.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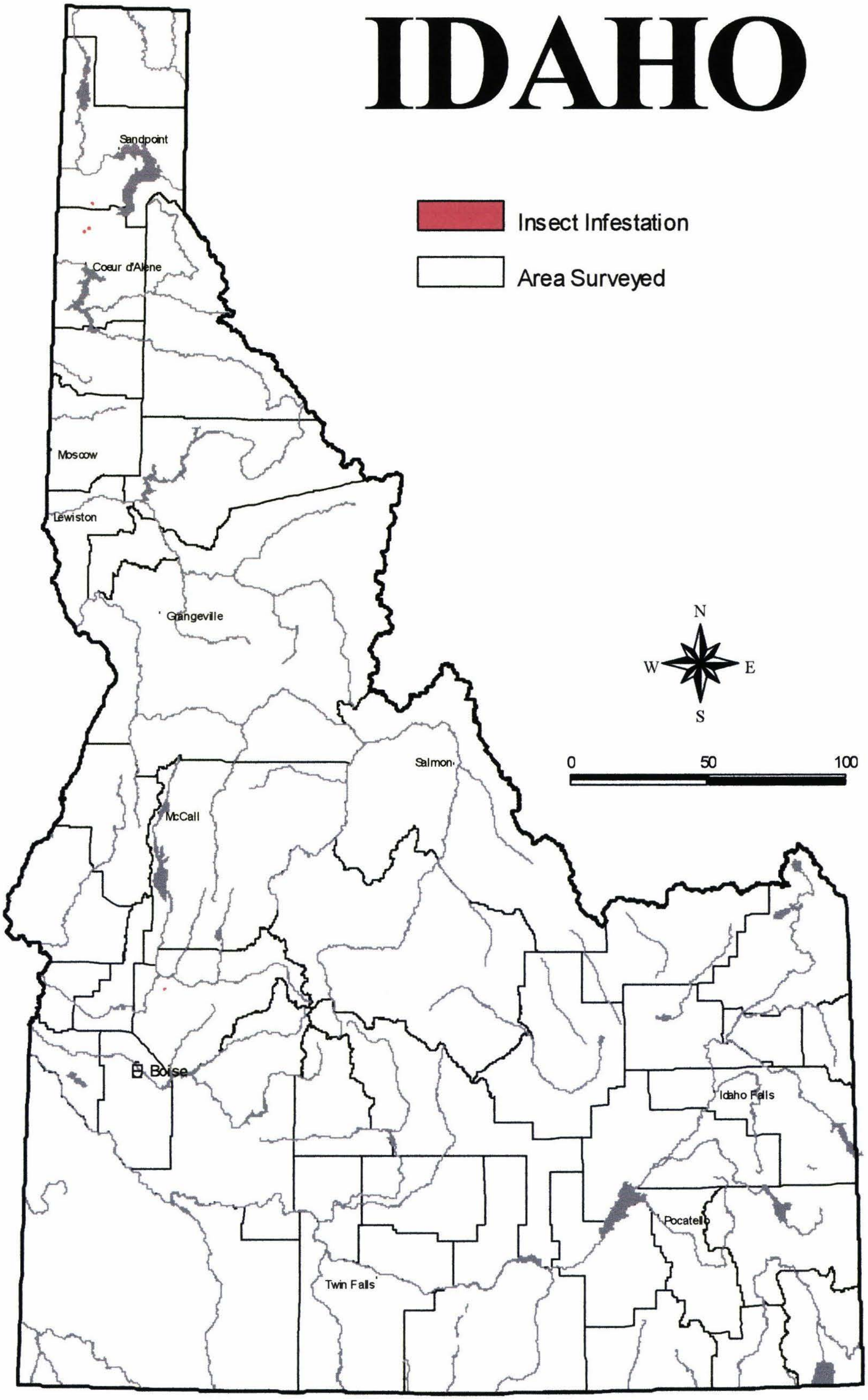
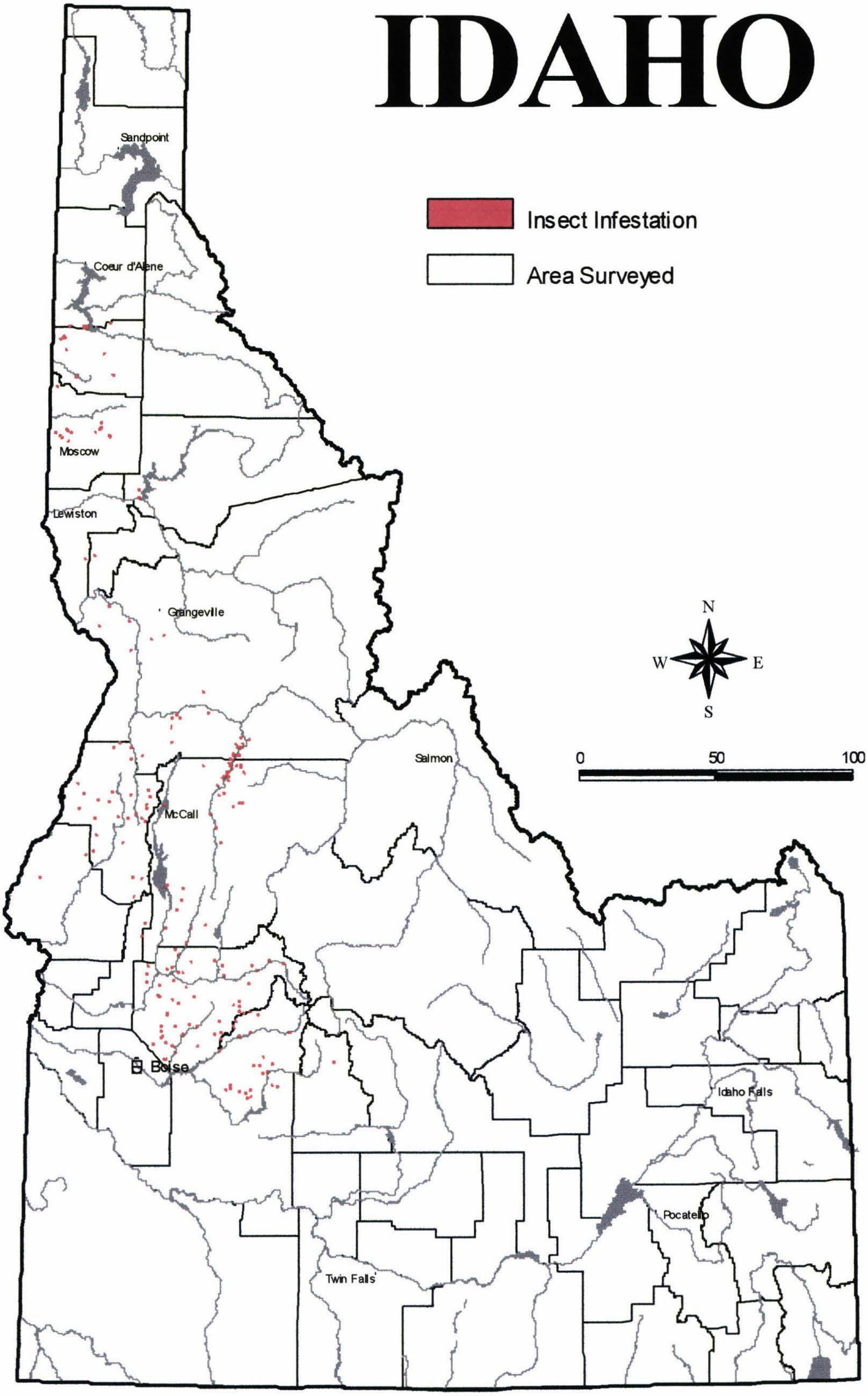
Moscow
Lewiston
Grangeville
McCall
Salmon
Boise
Idaho Falls
Pocatello
Twin Falls
N
W
E
S
0
50
100 Miles

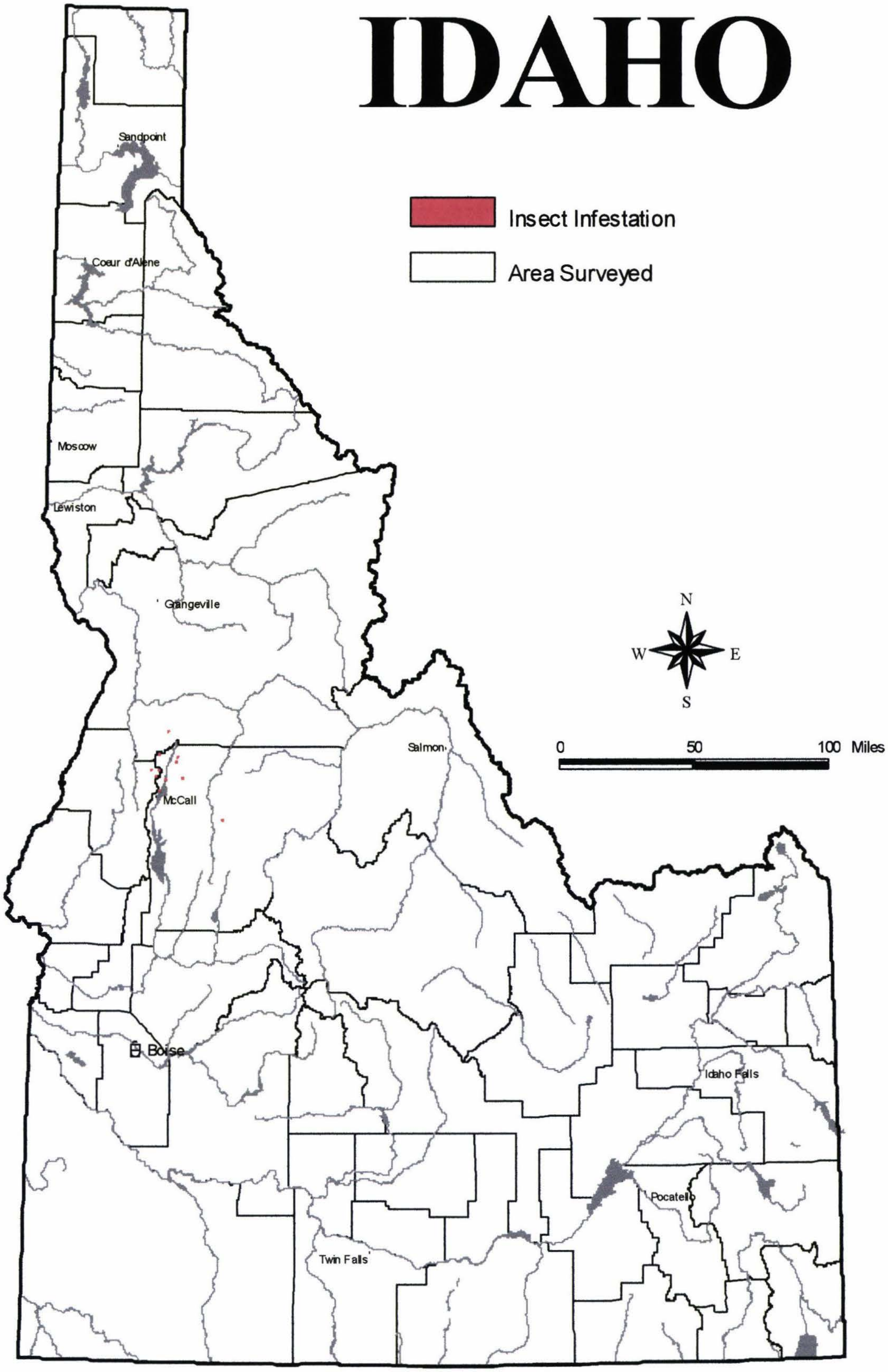
Map 97-1 Areas of Mountain pine beetle infestations in Idaho in 1997.


IDAHO
Insect Infestation
Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

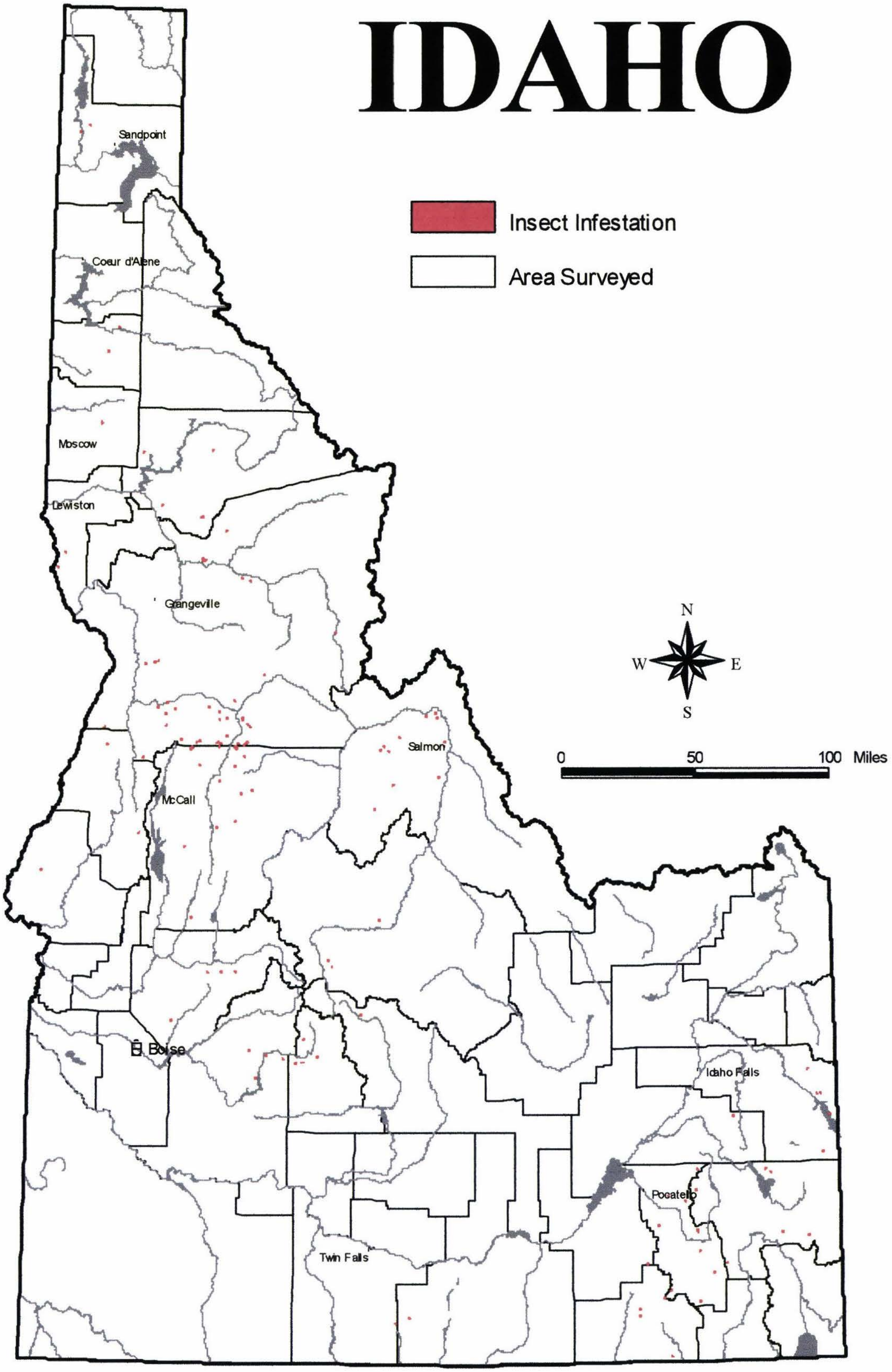
Map 97-2 Areas of Pine engraver beetle infestations in Idaho in 1997.


IDAHO
Insect Infestation
Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

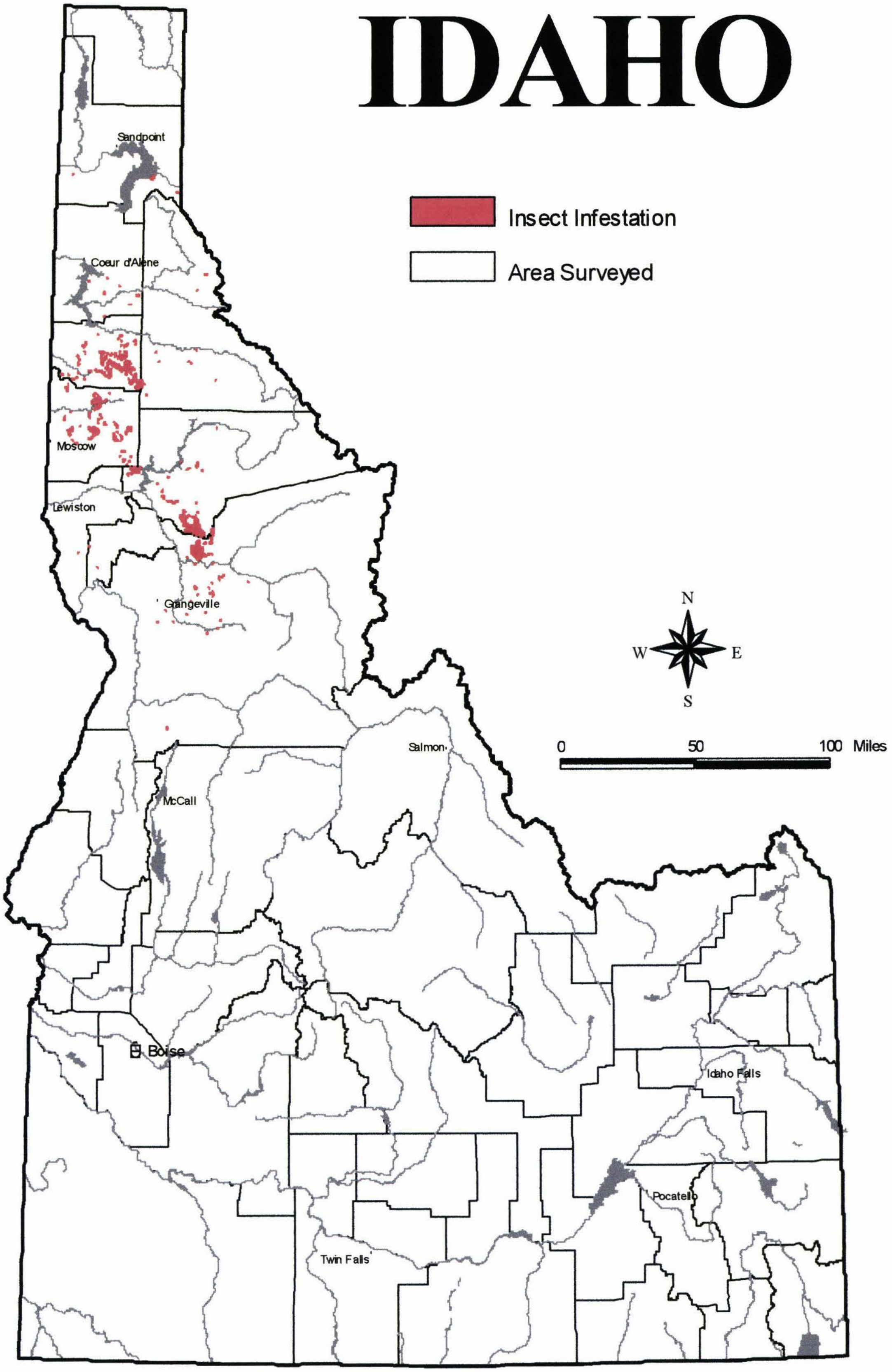
Map 97-3 Areas of Western pine beetle infestations in Idaho in 1997.


IDAHO
🟥 Insect Infestation
☐ Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

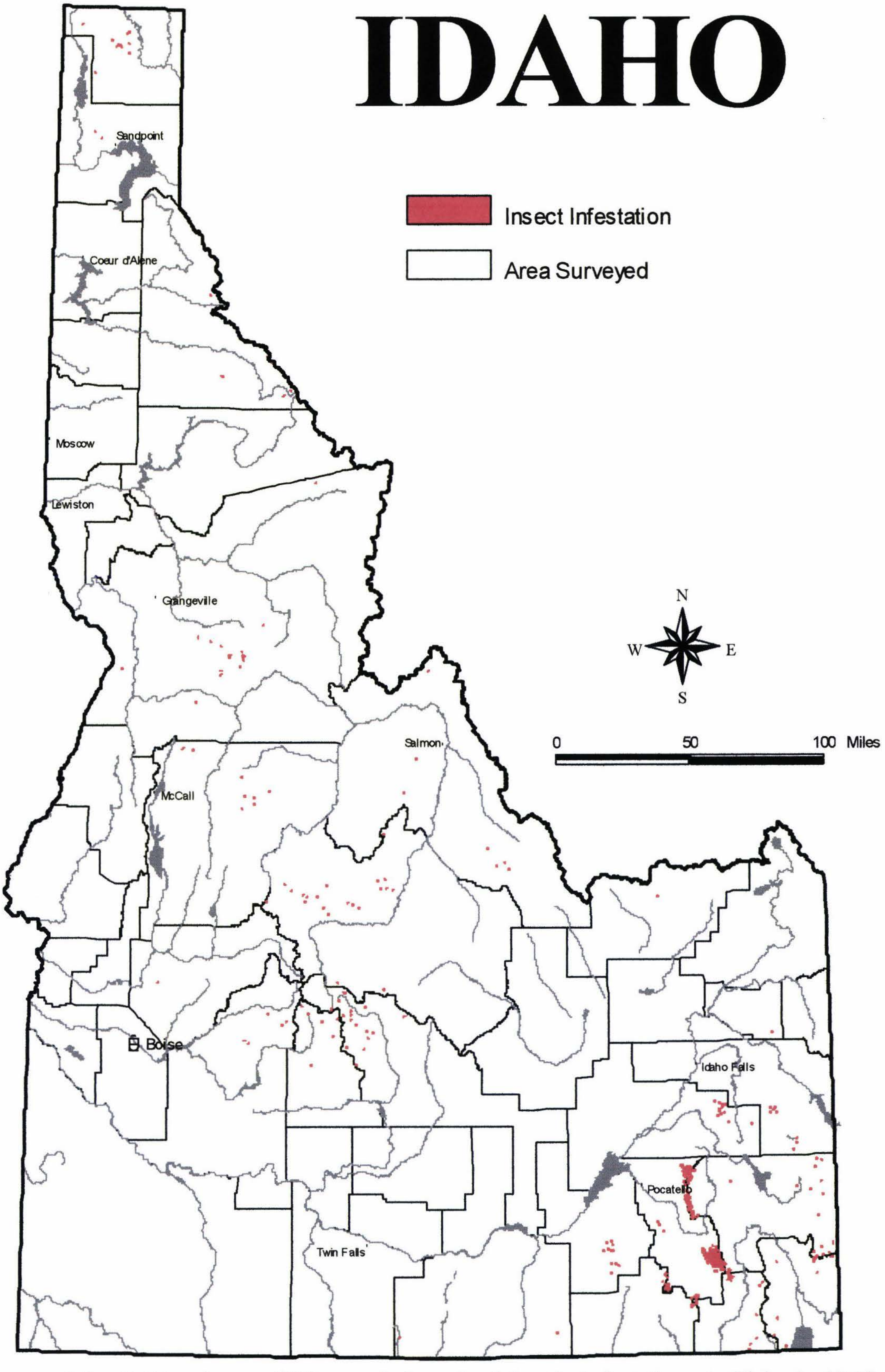
Map 97-4 Areas of Spruce beetle infestations in Idaho in 1997.


IDAHO
Insect Infestation
Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

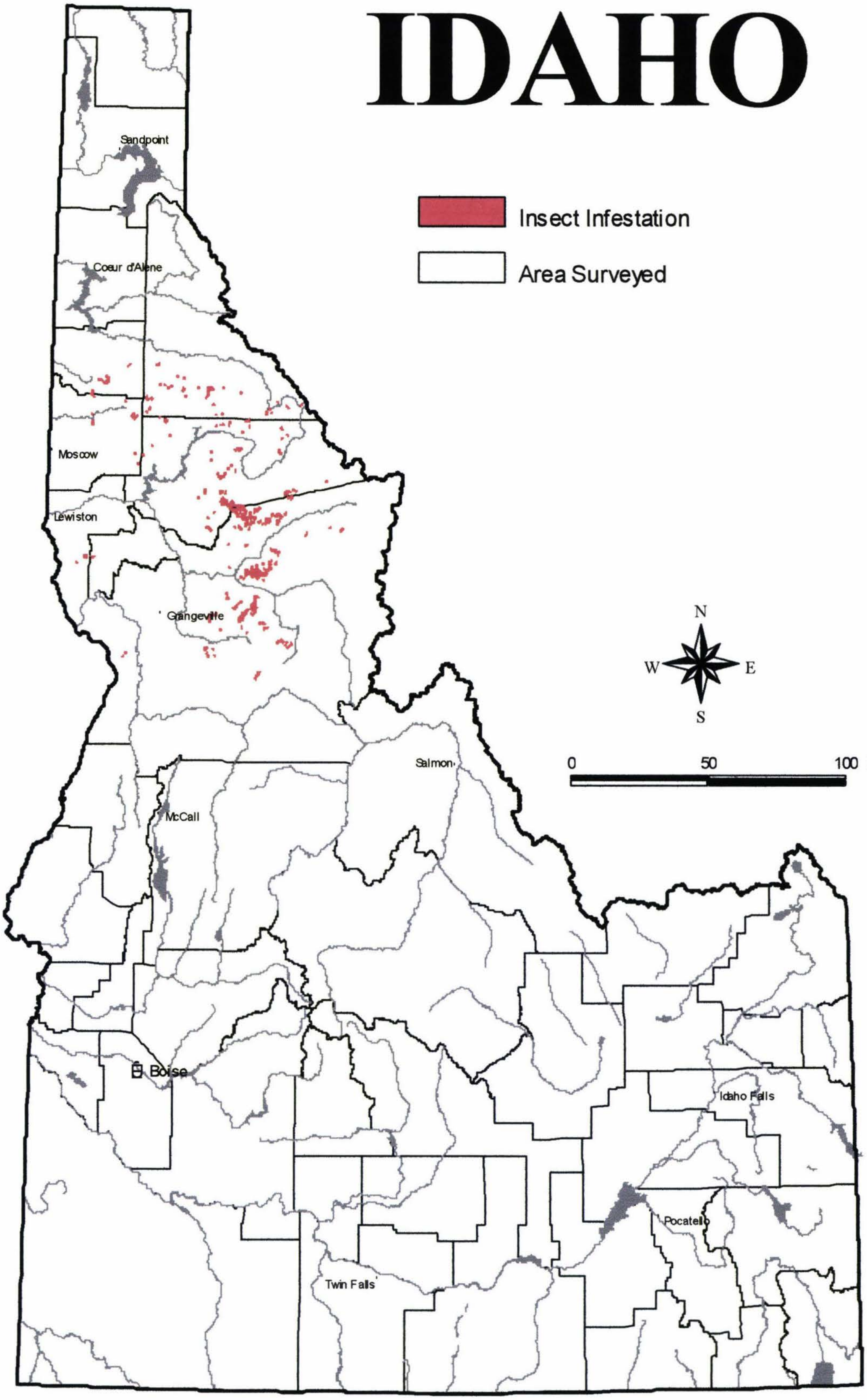
Map 97-5 Areas of Douglas-fir beetle infestations in Idaho in 1997.


IDAHO
🟥 Insect Infestation
☐ Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

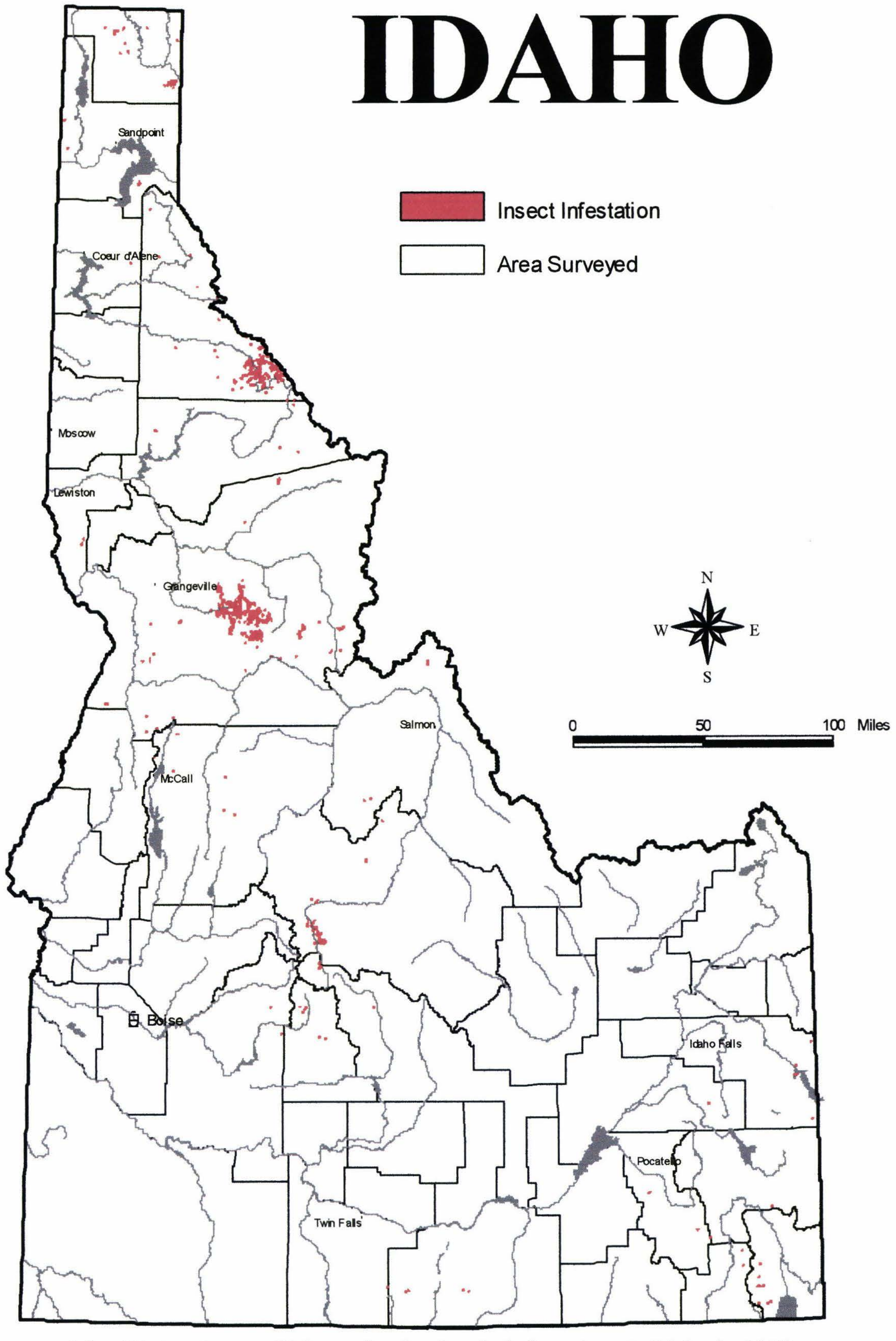
Map 97-6 Areas of Fir engraver beetle infestations in Idaho in 1997.


IDAHO
Insect Infestation
Area Surveyed
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
N
W
E
S
0
50
100 Miles
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

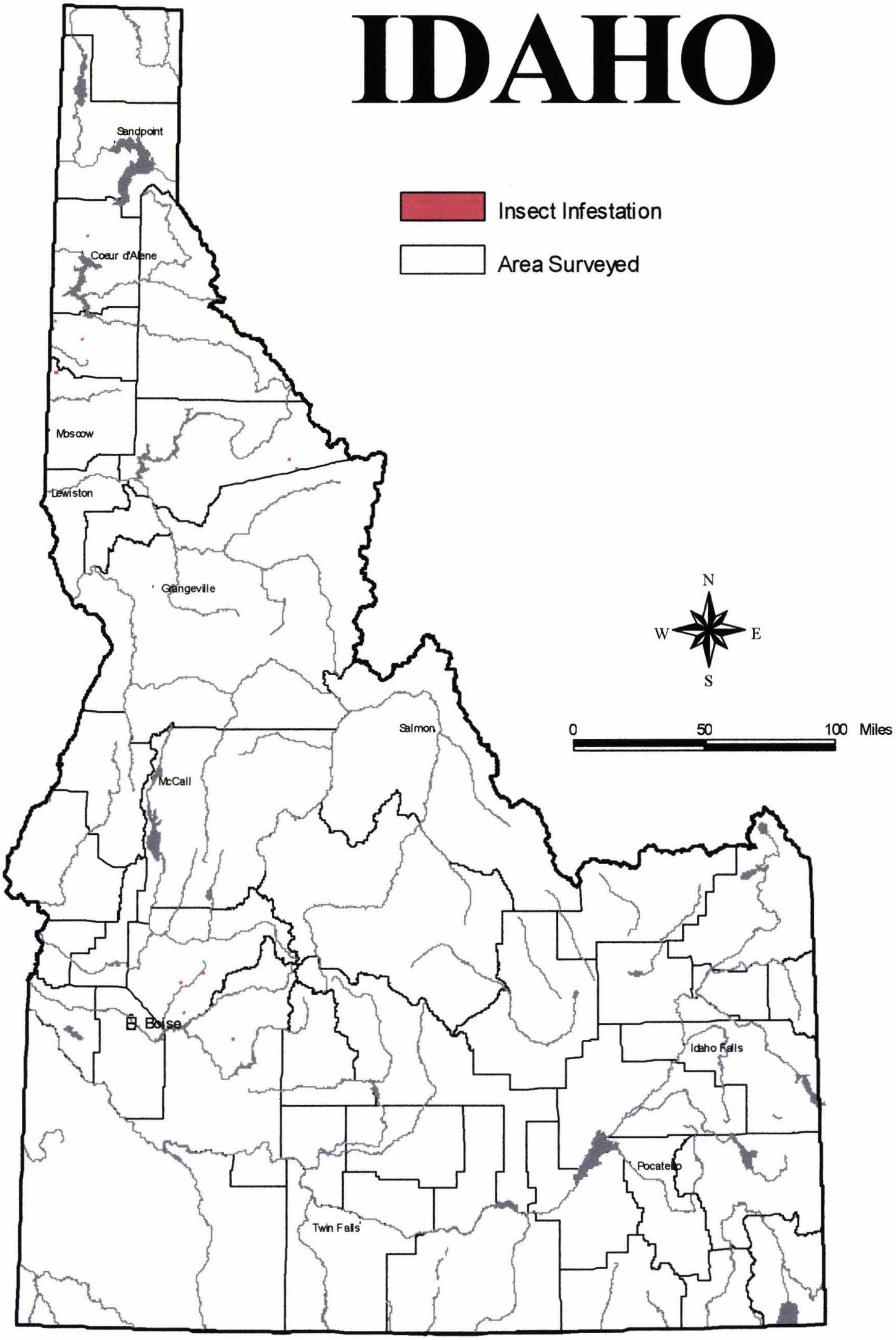
Map 97-7 Areas of Western balsam bark beetle infestations in Idaho in 1997.


IDAHO
🟥 Insect Infestation
☐ Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

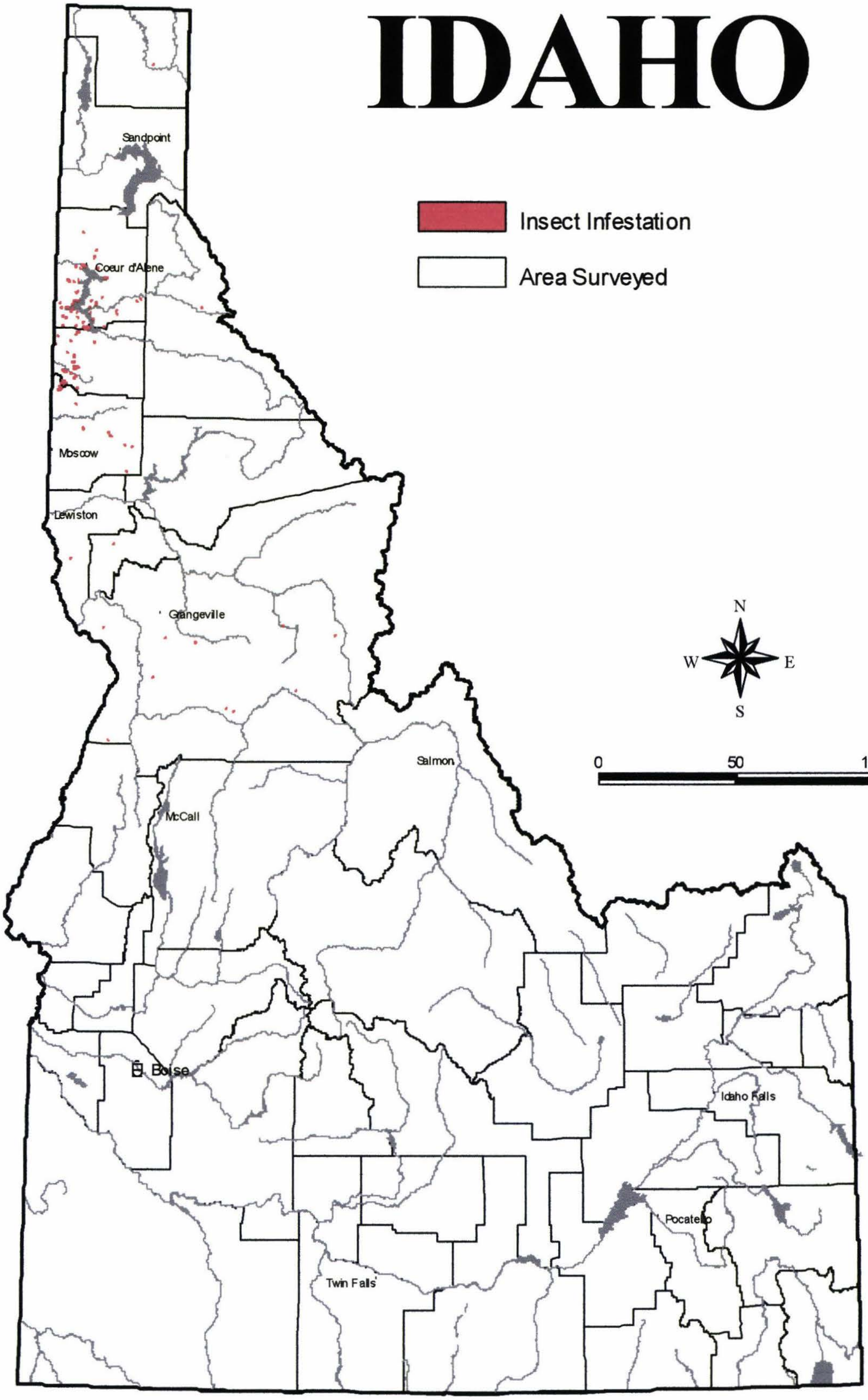
Map 97-8 Areas of Balsam Woolly Adelgid infestations in Idaho in 1997.


IDAHO
🟥 Insect Infestation
☐ Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

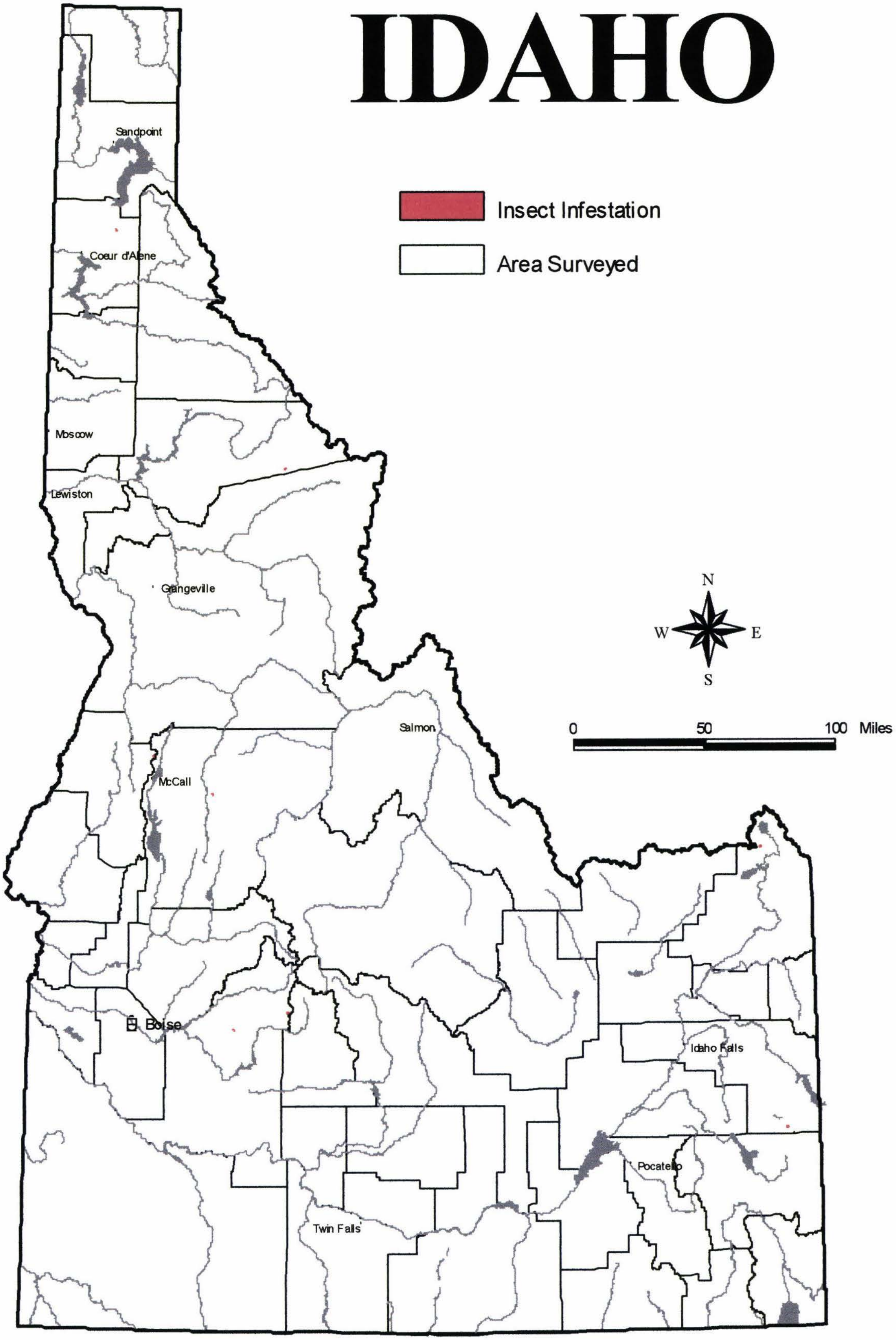
Map 98-1 Areas of Mountain pine beetle infestations in Idaho in 1998.


IDAHO
🟥 Insect Infestation
☐ Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

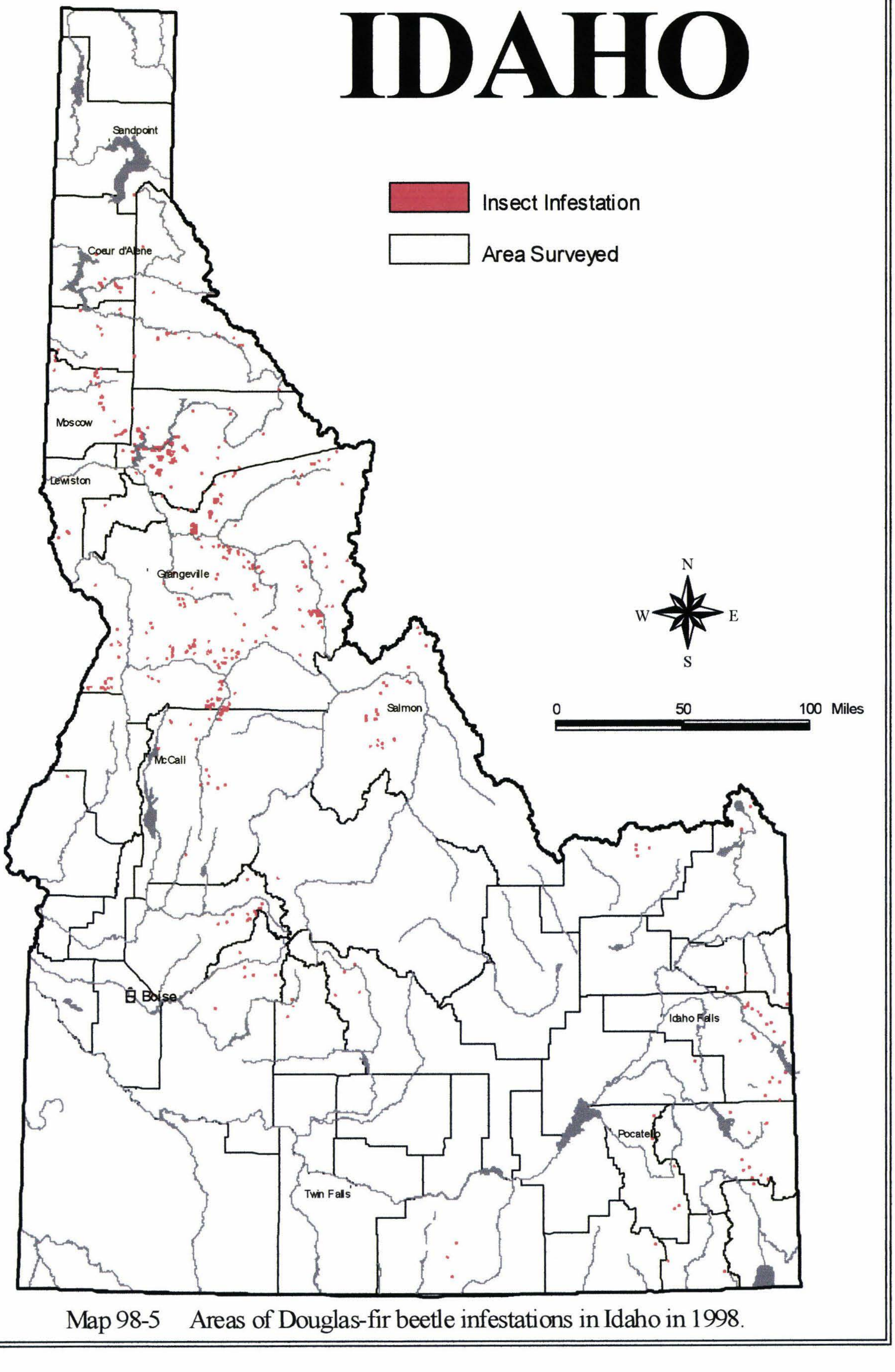
Map 98-2 Areas of Pine engraver beetle infestations in Idaho in 1998.


IDAHO
Insect Infestation
Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

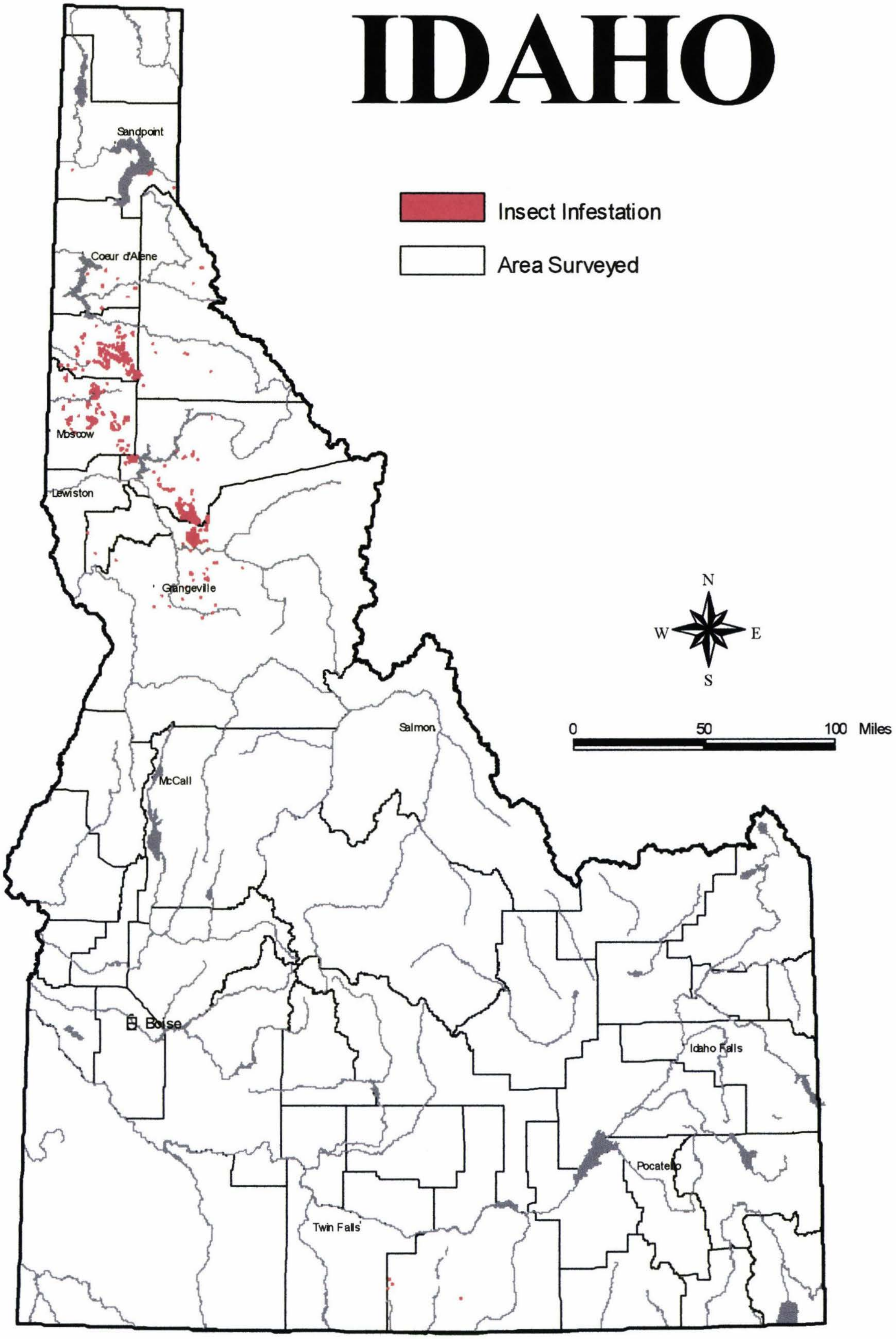
Map 98-3 Areas of Western pine beetle infestations in Idaho in 1998.


IDAHO
🟥 Insect Infestation
☐ Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

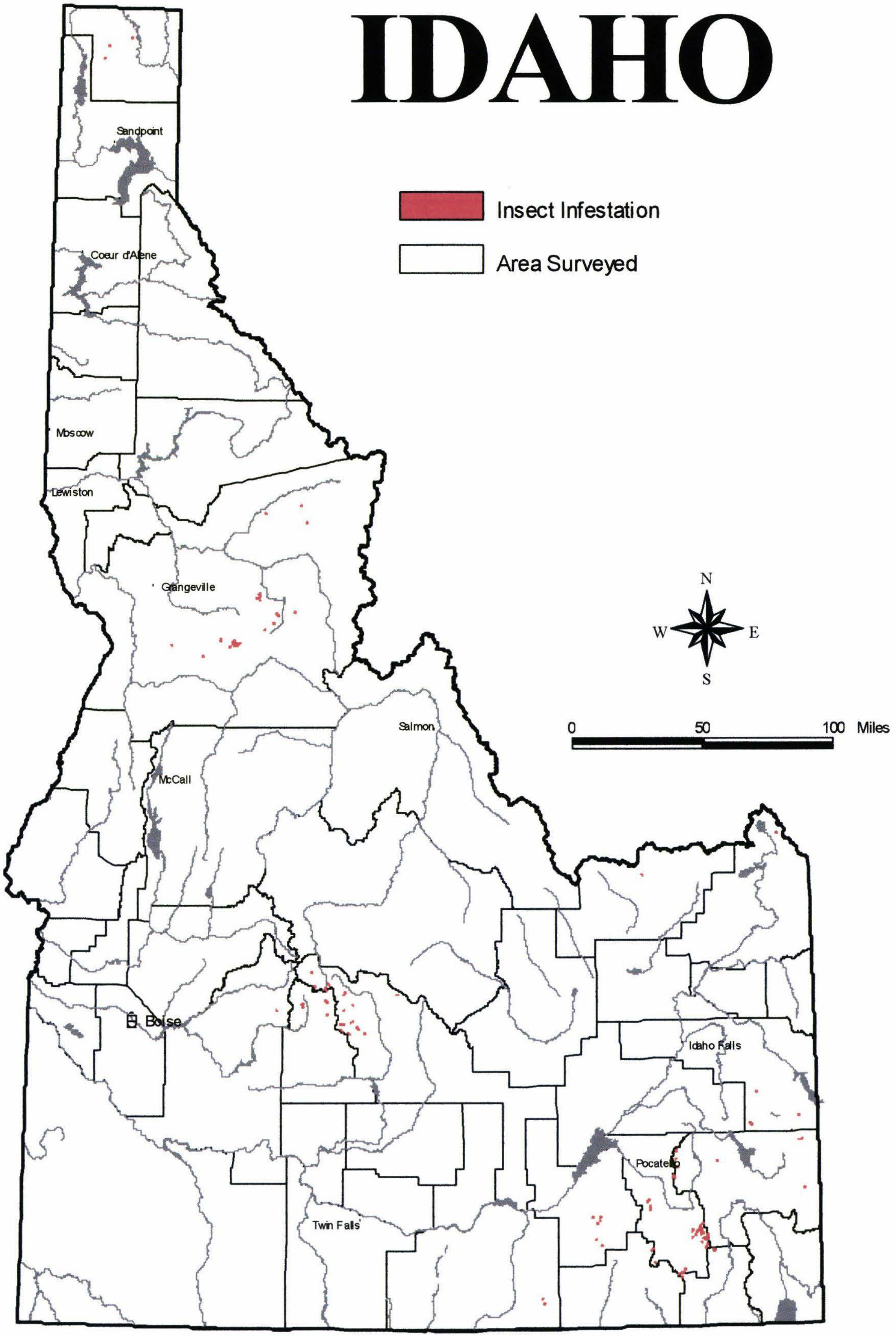
Map 98-4 Areas of Spruce beetle infestations in Idaho in 1998.


IDAHO
Insect Infestation
Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

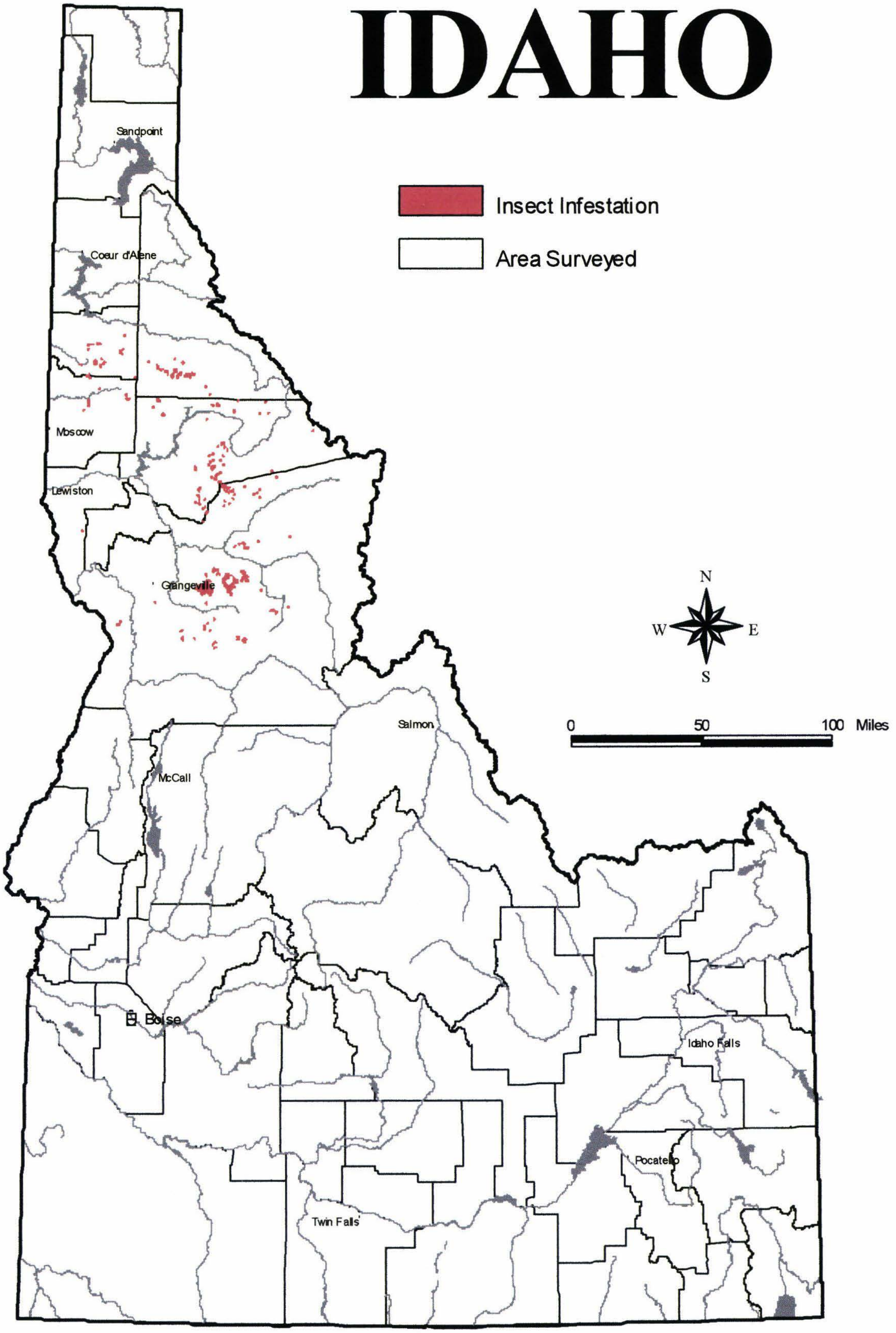
Map 98-5 Areas of Douglas-fir beetle infestations in Idaho in 1998.


IDAHO
Insect Infestation
Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

Map 98-6 Areas of Fir engraver beetle infestations in Idaho in 1998.


IDAHO
Insect Infestation
Area Surveyed
N
W
E
S
0
50
100 Miles
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls

Map 98-7 Areas of Western balsam bark beetle infestations in Idaho in 1998.


IDAHO
🟥 Insect Infestation
☐ Area Surveyed
Sandpoint
Coeur d'Alene
Moscow
Lewiston
Grangeville
Salmon
McCall
Boise
Idaho Falls
Pocatello
Twin Falls
N
W
E
S
0
50
100 Miles

Map 98-8 Areas of Balsam Woolly Adelgid infestations in Idaho in 1998.